Instruction Manual

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MODEL 1100-TVR(VT)
SATELLITE/TV RECEIVER

April 1976

MICRODYNE Corporation

POST OFFICE BOX 1527 • ROCKVILLE, MD. 20850

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SAFETY PRECAUTIONS

The following are general safety precautions that are not related to any specific procedure and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

HIGH VOLTAGE

Operating and maintenance personnel must at all times observe all safety precautions. Care must be exercised when performing maintenance in and around the line filter, the power transformer, and the rear panel. Line voltage is present in the vicinity of the Power ON/OFF switch on the rear panel, pins 1 and 2 of the power transformer and E10 to E15 of the power deck. The plastic cover on the deck is a safety device and should not be removed.

DO NOT SERVICE OR ADJUST ALONE

Maintenance personnel should not service or adjust the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

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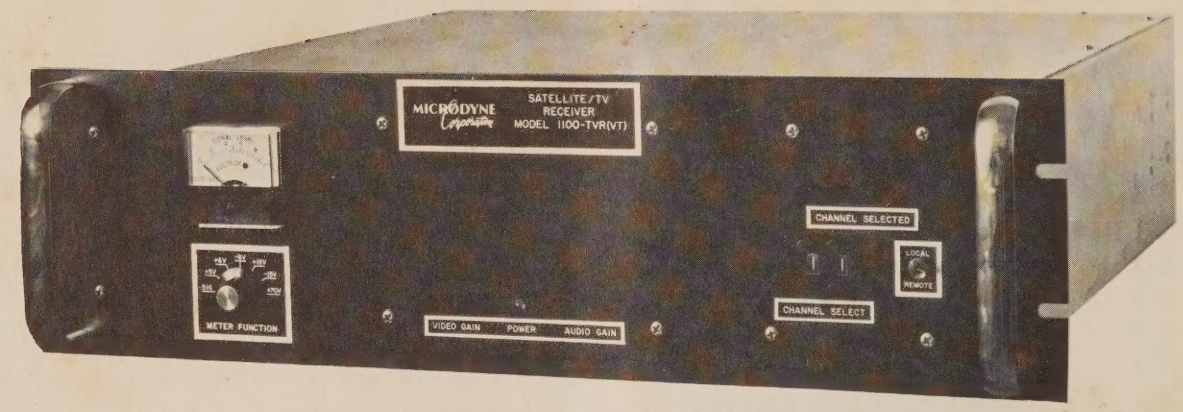


Model 1100-TVR(VT) Satellite/TV Receiver

SECTION I
GENERAL INFORMATION

1-1 SCOPE

This manual provides installation, operating, and maintenance information for the Model 1100-TVR(VT) Satellite/TV Receiver. This manual is composed of seven sections plus supplementary instruction booklets that describe the modular assemblies. The instruction booklets contain functional descriptions and maintenance data, including replaceable parts lists and maintenance diagrams for the assemblies. The overall receiver is discussed herein.

Section I, beginning with paragraph 1.2, describes the purpose and capabilities of the receiver and includes the overall receiver performance specifications. Sections II and III provide the receiver installation and operating instructions.

The theory of operation is given in Section IV, and includes a description of the receiver on a functional block diagram level as detailed circuit descriptions are given in the supplementary instruction booklets. Section V is the maintenance section of the manual and provides preventive and corrective maintenance requirements for the receiver.

A replaceable parts list is given in Section VI and contains an alphanumerical list of the electrical components used in the base chassis of the receiver. Maintenance diagrams for the receiver base chassis are included in Section VII.

The supplementary instruction booklets for the modular assemblies are provided at the rear of this manual behind tab separators.

1-2 PURPOSE AND CAPABILITIES

The Model 1100-TVR(VT) Satellite/TV Receiver is a wideband FM receiver designed to function as a complete down-link receiver for use in Satellite Television Receiving Systems in such application as:

a. Reception of down-link from Communications Satellites.

b. Reception of TV video for CATV (head end equipment).

c. Reception of broadband meterological or earth sensing data from satellites.

d. Military TV such as RPV's, etc.

The rf tuner in the receiver interfaces with the antenna preamplifier at 3.7 GHz to 4.2 GHz. A voltage-tuned, four-pole preselector provides non-mechanical local and remote tuning capabilities across the signal band. Tuning interface is TTL-compatible BCD coded. Tuning

selection of any of the 24 channels is accomplished locally by a BCD coded switch or may be remotely selected by the application of an appropriate BCD coded command word. A two digit display is provided on the front panel to indicate the selected channel.

The rf tuner features a local oscillator having a stability of 0.0005%/°C over the temperature range from 0° to 50°C, thus eliminating the need for any crystals.

IF filter group delay characteristics are optimized using phase equalization techniques. The absolute group delay variation over the IF passband is nominally 3 nanoseconds. A wide range of IF filter bandwidths is available.

The FM demodulator supplied with the 1100-TVR(VT) Receiver is of an advanced design which, together with IF and post detection circuit performance, results in an improved FM threshold characteristic. Threshold typically occurs at 8 dB C/N ratio, producing 44 dB video S/N ratio.

The standard video output is the de-emphasized picture video with the 30 Hz triangular dispersal signal clamped to better than 50 dB. Nominal video output level is 1V peak-to-peak into a 75 ohm load, with a continuous front panel adjustment range of ±0.5 volts.

Internally-mounted subcarrier demodulators are available for all EIA standard frequencies.

A multi-function meter indicates the signal strength and the level of all the power supply voltages.

The electrical, environmental, and physical specifications are listed in table 1-1.

Table 1-1. Specifications

ELECTRICAL:	
Type	Single conversion, superheterodyne.
Input:	
Frequency	3.7 to 4.2 GHz.
Impedance	50 ohms nominal.
VSWR	1.5:1 maximum.
Preselector RF Bandwidth	40 MHz minimum at 0.5 dB.
Dynamic Range	-20 dBm to -85 dBm.
Noise Figure	12 dB maximum, 10 dB nominal.
Local Oscillator Mode	VFO (channel selectable).
Local Oscillator Stability	0.0005%/°C over the temperature range from 0°C to +50°C.
IF Frequency	70 MHz.
IF Bandwidth Options	17.5 MHz, 25 MHz, 30 MHz, 36 MHz, 40 MHz bandwidths are standard. Other bandwidth options available.
IF Rejection	80 dB minimum.
AGC Range	65 dB minimum.
Demodulator:	
Type	FM.
Linearity	Linear to within ±1% over ±18 MHz.

continued

Table 1-1, continued

Electrical, continued	
Video Outputs:	
Frequency	10 Hz to 4.2 MHz ±0.5 dB at clamped output.
Impedance	75 ohms (50 ohms optional).
Level	1 volt peak-to-peak.
Level Adjustment	±0.5 volt continuous front panel adjustment.
De-Emphasis	525 CCIR Recommendation 405-1 standard. Other de-emphasis filters optional.
Polarity	Black to white transitions positive going. Reverse polarity optional.
Clamping	50 dB for 30 Hz triangular dispersion waveform.
Non-Linear Distortion:	
Differential Gain	±0.2 dB maximum, 10 to 90% APL.
Differential Phase	Less than ±1°, 10 to 90% APL.
2T Pulse Distortion	Less than 2%.
Linear Distortion:	
Line Time Distortion	Less than ±1.5%.
Field Time Distortion	Less than ±1.5%.
Chrominance/Luminance Gain Inequality	±0.3 dB maximum.
12.5T Delay Inequality	Less than ±25 nanoseconds.

continued

Table 1-1, continued

Electrical, continued	
Audio Outputs:	
Subcarrier Frequency	6.2 MHz, 6.8 MHz, 7.5 MHz standard. Other frequencies available as options.
Frequency Response	20 Hz to 15 kHz ±0.5 dB.
De-Emphasis	75 microseconds time constant. Other options available.
Output Level	Continuously adjustable from 0V to +10 dBm.
Impedance	600 ohms balanced.
Harmonic Distrotion	1% maximum.
Additional Audio Channels	Multiple subcarrier audio channels available as options.
Metering and Controls	See Section III for descriptions.
ENVIRONMENTAL:	
Temperature:	
Operating	0 to 50°C.
Storage	-60° to +60°C.
Atmospheric Pressure:	
Operating	To 10,000 feet.
Storage	To 50,000 feet.
MECHANICAL:	
Size	$5\frac{1}{4}$" H x 19" W x 20" D.
Weight	Approximately 37 pounds.
Prime Power	115/230V AC. 50 to 400 Hz standard. Operation from 24/48V DC source optional.

SECTION II
PREPARATION FOR USE

2-1 GENERAL

The 1100-TVR(VT) Receiver is designed for mounting in a standard 19-inch equipment rack or cabinet. The unit requires a panel space of 5-1/4 inches. An outline drawing of the receiver is shown in figure 2-3.

2-2 UNPACKING AND HANDLING

The 1100-TVR(VT) is shipped with all subassemblies installed. The receiver is sealed in a polyethylene bag and packed in a polystyrene shipping case which is sealed with tape. To open the case, lay it flat with the top side up. Cut the tape and remove the receiver package. Place the receiver chassis on a bench and remove the bag. Thoroughly check each chassis for intransit damage; i.e., a broken meter face, damaged connectors, dents, broken knobs. If damaged, notify the proper authorities immediately.

NOTE

Do not destroy the packing cases if the receiver is to be stored or transferred to another site.

If the receiver was ordered with rack slides, the receiver portions of the slide assembly are installed before shipment and the rack portions shipped in a separate carton.

2-3 INSTALLATION

No special hardware or procedures are required to mount the receiver in the equipment rack.

After mounting, all connections between the receiver and the companion equipment in the receiving system should be completed. Table 2-1 provides a list of the receiver input/output connectors, their function, type, and the cable requirement.

2-3.1 PRIMARY POWER

Unless otherwise requested, the 1100-TVR(VT) is shipped wired for operation with a 115V AC input. Should it become necessary to operate at 230V AC, the primary of transformer T1 in the power supply of each chassis must be rewired for 230 volt operation. Figure 2-2 shows the transformer wiring for both 115V AC and 230V AC operation. Access to the transformer is obtained by removing the top cover. A power cord is supplied wired to the receiver chassis.

2-4 STORAGE AND HANDLING

Storage conditions must not exceed the environmental limitations specified in table 1-1. In addition, the receiver should also be sealed with a quantity of desiccant in a moisture proof container during the storage period. It is recommended that the receiver be stored in the shipping cartons. No special handling equipment is required for the receiver although care must be exercised to prevent shock and vibration.

2-5 PACKAGING FOR RESHIPMENT

Should it become necessary to repack the receiver for shipment, proceed as follows:

a. Place the receiver and a quantity of desiccant into a moisture proof polyethylene bag and seal.

b. If the original polystyrene shipping case is available, place the unit into the case and seal with shipping tape. If the original case is not available, proceed as follows:

   1. Place the chassis into a heavy duty cardboard box using sufficient padding to prevent movement.

   2. Seal the carton and place it into a second carton or shipping crate, again using sufficient padding to prevent movement. Seal this carton.

c. Affix the necessary "Fragile" and "Delicate Equipment" labels.

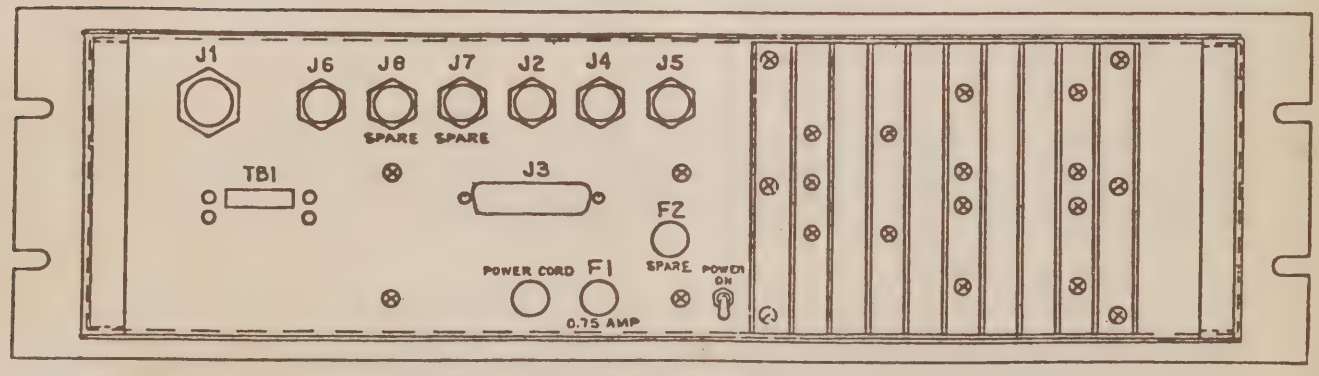


Figure 2-1. Rear Panel Drawing

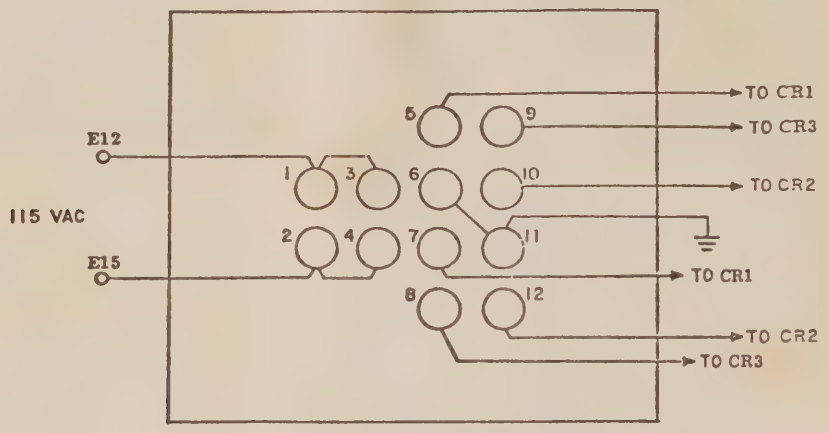
Table 2-1. Connector Function/Cabling

Connector	Function	Type/Impedance	Recommended Cable
J1 RF In	Input to RF Tuner 3.7-4.2 GHz	N, 50 ohms	RG-223/U or RG-9/U
J2 Video Out	Output for Video Signal	BNC, 75 ohms	RG-59/U
J3 Accessories	Control and Voltage Lines to/from IF/Demodulator Unit	Cannon DBM-25S	24 AWG
	Pin 1 - Ground Pin 2 - +15V Pin 3 - +6V Pin 4 - -6V Pin 5 - -15V Pin 6 - +5V	These power supply voltages are made available for monitoring and for driving external equipment as required.	
	Pin 14 - AGC Output		
			For dual line inputs (see paragraph 3-4):
	*Pin 7 Pin 8 *Pin 9 Pin 10 Remote tens Decade (Channel Select)		7, 8 twisted pair 9, 10 twisted pair
	*Pin 11 Pin 12 *Pin 13 Pin 19 *Pin 15 Pin 16 *Pin 17 Pin 18 Remote Units Decade (Channel Select)		11, 12 twisted pair 13, 19 twisted pair 15, 16 twisted pair 17, 18 twisted pair
	*True Input Lines		
J4 LO Monitor	1/16 LO Injection Frequency	BNC, 75 ohms	RG-223/U

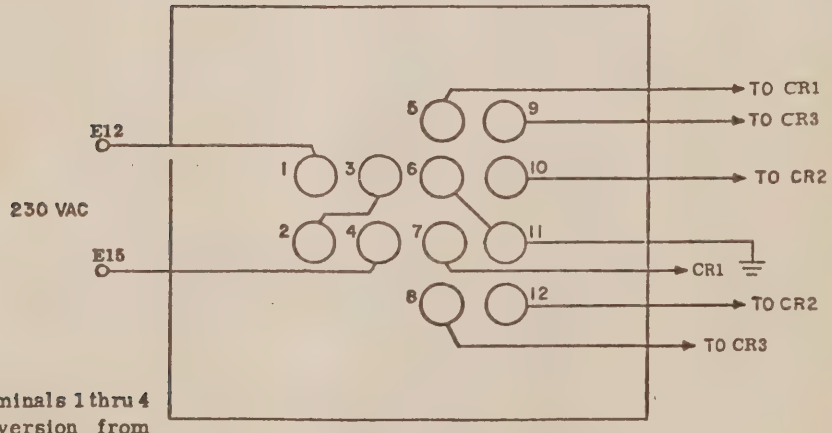
- continued -

Table 2-1, continued

Connector	Function	Type/Impedance	Recommended Cable
J5 IF Monitor	70 MHz IF Monitor	BNC, 75 ohms	RG-223/U
J6 Video Syn	Horiz Sync Pulses	BNC/10K	RG-223/U
TB1 Audio Out 600 ohms Bal	Audio Output 600 ohm Bal- anced Line	Terminal Block	24 AWG



A. STRAPPING—115 VAC INPUT



NOTE:
Only the wiring to terminals 1 thru 4 are affected by conversion from 115V ac to 230V ac or vice versa.

B. STRAPPING—230 VAC INPUT

Figure 2-2. Power Transformer Strapping

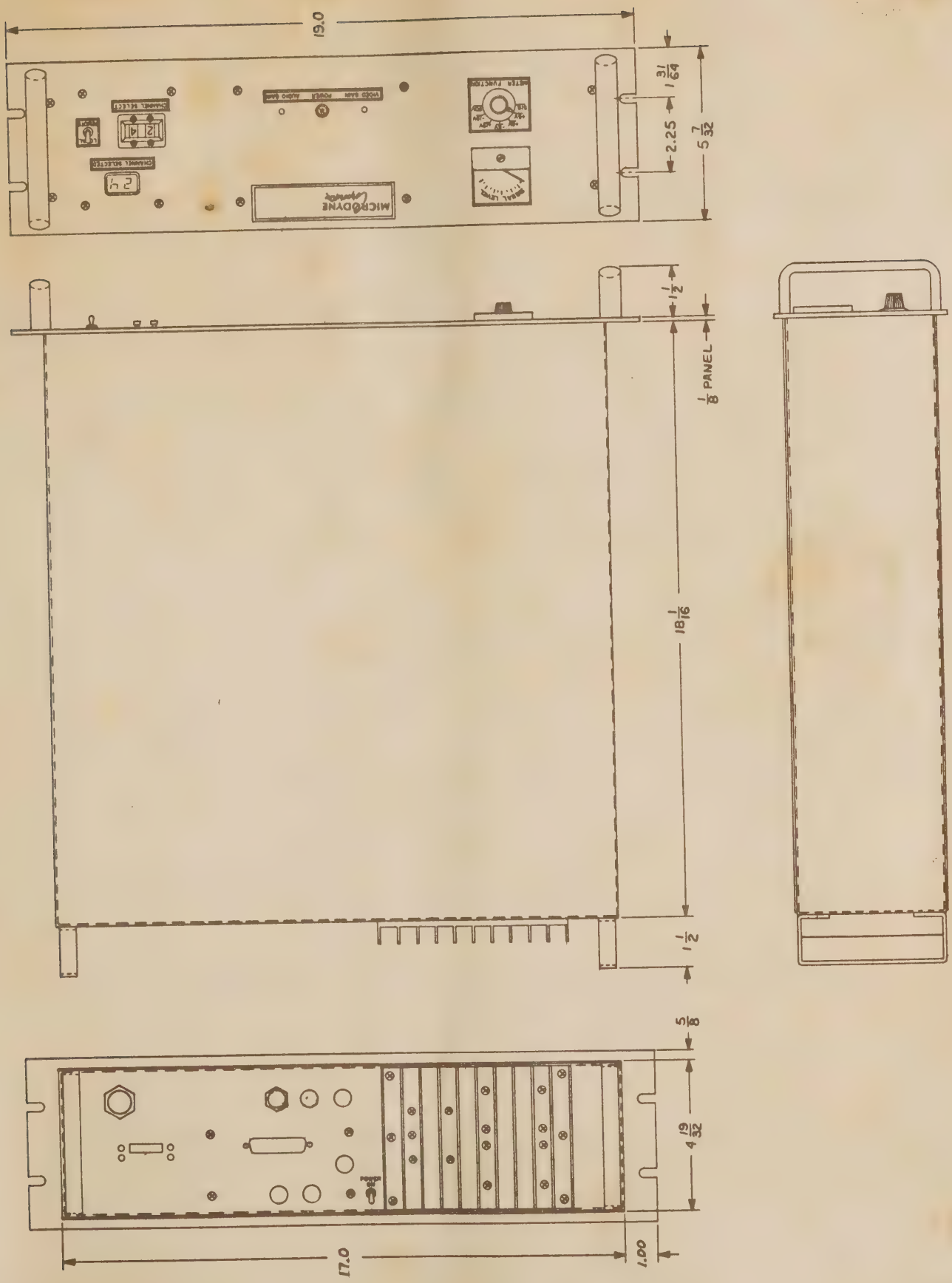


Figure 2-3. Outline Drawing

SECTION III
OPERATION

3-1 INTRODUCTION

Provided herein are the recommended operating instructions for the 1100-TVR(VT) Receiver. These instructions are generalized as the specific procedures depend on how the receiver is employed in the television receiving system.

3-2 CONTROLS AND INDICATORS

Functional description of the operating controls and indicators is given below:

Multi-function Meter	This meter indicates the level of the power supply dc voltages, +5V, +6V, -6V, +15V, -15V, and +70V*, and the signal strength. The voltages to be monitored are selected by companion METER FUNCTION switch. The meter permits the operator to rapidly check the status of the power supply without interrupting the mission and to monitor the relative signal strength.
POWER	This indicator will light when primary power is applied to the unit. The application of power is made by the POWER ON/OFF toggle switch located on the rear panel.
LOCAL/REMOTE	This switch is used to select either local or remote channel select. In the Local mode, channel selection is made locally at the receiver. In the Remote mode, channel selection may be made by the use of an externally applied BCD coded command signal.
CHANNEL SELECT	This BCD coded switch is used to select the desired signal channel when the Local/Remote switch is in the local position.
CHANNEL SELECTED	This digital readout indicates the signal channel being processed by the rf tuner.

continued

*The 70V is unregulated and is referenced to a 115V AC line voltage. A higher or lower line voltage will cause a higher or lower meter indication (70V), this will not affect the operation of the receiver.

VIDEO GAIN	This control permits adjustment of the video output signal ±0.5 volts around the nominal 1 volt peak-to-peak level.
AUDIO GAIN	This control permits adjustment of the audio output level from 0V to +10 dBm.
AGC/MAN	Internal control used to select either automatic gain control (AGC) or manual gain control.
Manual GAIN Control	Internal control adjusts manual gain level (65 dB range).

3-3 OPERATIONAL SETUP PROCEDURES

a. Ensure the cabling between the receiver and the companion system equipment is in place; see table 2-1, Section II.

b. Apply power to the receiver by placing the POWER switch in the ON position. Check the power supply voltages using the front panel meter; switch through each meter position.

c. Place the LOCAL/REMOTE switch in the LOCAL position. Note that the Channel Select Display readout corresponds to the setting of the Channel Select switch.

d. Place the METER FUNCTION switch to the SIG position. The meter should indicate the presence of a signal. The receiver is now operational and a video signal should be present on the system's video monitor.

e. The Video Gain control is factory set for 1 volt peak-to-peak into 75 ohms. The Video Gain control on the front panel may be readjusted for another desired video level.

f. Adjust the Audio Gain control for the desired audio level.

g. Check the signal level meter calibration; see paragraph 3-3.1.

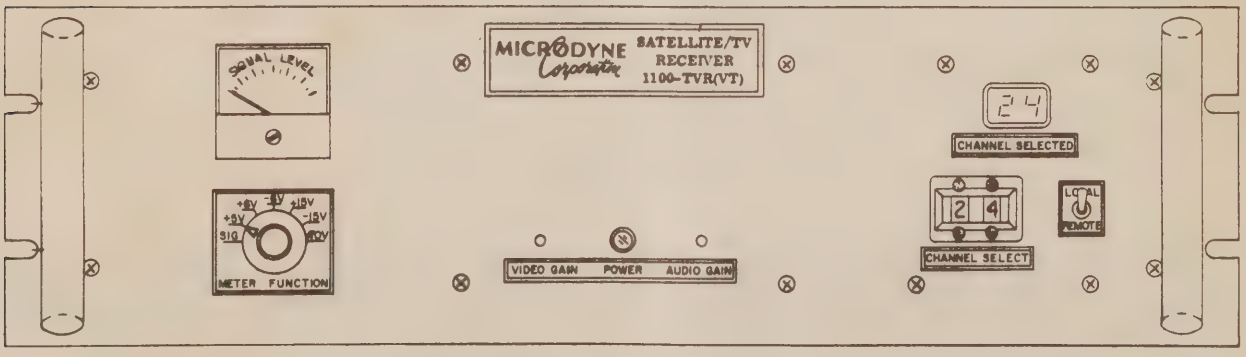


Figure 3-1. Front Panel Drawing

3-3.1 SIGNAL LEVEL METER CALIBRATION

a. Remove the top cover from the receiver to gain access to the AGC switch and associated controls.

b. Disconnect the rf signal from connector J1.

c. Set the AGC switch, located on the power deck, to the AGC position.

d. Place the Meter Function switch in the SIG position.

e. Adjust the AGC ZERO control on the power deck for a zero indication on the front panel meter.

f. Set the AGC switch to the MAN (manual) position.

g. Connect a DC voltmeter to the AGC test point (E26). E26 is accessible through the safety shield on the power deck.

h. Adjust the GAIN control for a -5.0V DC indication on the voltmeter. Remove the voltmeter.

i. Adjust the 60 dB control on the power deck for a full scale indication on the front panel meter.

NOTE

The front panel meter does not indicate the absolute rf signal level; the reading is only a reference indication of the level of the signals and is used for making comparisons. The full scale calibration may be made using an AGC voltage other than -5.0V DC. The lower the full scale voltage, the more sensitive the meter will be to signal variations. -5.0V DC is recommended as a protection to the meter.

j. Place the AGC switch to the AGC position. Reconnect the rf input cable to J1, the rf input connector.

k. Select the desired rf channel. The front panel meter should indicate the presence of the rf signal. Readjust the 60 dB control for the desired indication on the meter.

l. Replace the top cover on the unit.

3-4 REMOTE CHANNEL SELECTION

The selection of the channel may be made from a remote location using a digital control device that is capable of supplying the required BCD coded, TTL compatible control signal.

The BCD control lines would be connected to pins 7 through 20 of the accessories connector J3; see table 2-1. For a locally located control unit, the BCD control lines are connected only to the true input lines. If the remote control unit is located over 125 feet from the 1100-TVR(VT) Receiver, the rf tuner must be equipped with dual line receivers (option) in its local/remote decoder to provide sufficient amplification of the control signal to drive the decoder logic. These balanced input receivers require both the true and non-true BCD inputs. The remote control unit must provide the true and non-true lines and provide the necessary drive for these logic receivers. The control lines should be in the form of twisted pairs as noted in table 2-1.

The channel coding, or the logic levels that must appear on the control lines to select a gain channel, is given in table 3-1. The table lists only the logic levels that should appear on the true input lines. In the case where the dual line receivers are employed in the tuner, the opposite logic level must appear on the companion or untrue lines of the twisted pair. For example, if the table lists a logic 1 on line J3-7, then a logic 0 must appear on line J3-8. The true input lines are those connected to pins 7, 9, 11, 13, 15, and 17 of connector J3; the companion untrue lines are pins 8, 10, 12, 19, 16, and 18, respectively.

Table 3-1. Channel Coding True Input Lines

Channel	Tens Digit		Units Digit			
	J3-7	J3-9	J3-11	J3-13	J3-15	J3-17
1	0	0	1	0	0	0
2	0	0	0	1	0	0
3	0	0	1	1	0	0
4	0	0	0	0	1	0
5	0	0	1	0	1	0
6	0	0	0	1	1	0
7	0	0	1	1	1	0
8	0	0	0	0	0	1
9	0	0	1	0	0	1
10	1	0	0	0	0	0
11	1	0	1	0	0	0
12	1	0	0	1	0	0
13	1	0	1	1	0	0
14	1	0	0	0	1	0
15	1	0	1	0	1	0
16	1	0	0	1	1	0
17	1	0	1	1	1	0
18	1	0	0	0	0	1
19	1	1	1	0	0	1
20	0	1	0	0	0	0
21	0	1	1	0	0	0
22	0	1	0	1	0	0
23	0	1	1	1	0	0
24	0	1	0	0	1	0

SECTION IV
THEORY OF OPERATION

4-1 INTRODUCTION

As circuit descriptions of the receiver subassemblies are provided in supplemental instruction booklets, this section provides a description of the 1100-TVR(VT) on a functional block diagram level only. A functional block diagram is shown in figure 4-1.

4-2 FUNCTIONAL DESCRIPTION

The 3.7 GHz to 4.2 GHz rf input from the antenna system is coupled to J1 on the rear panel of the receiver. The rf signal is then routed to the rf tuner which functions to select the desired rf channel and convert it to a 70 MHz IF signal.

In the tuner, the rf signal is routed through a preamplifier to a voltage-controlled preselector which selects the appropriate channel signal from the 3.7 GHZ - 4.2 GHz input. The selected channel signal is then coupled to a mixer where it is combined with a local oscillator signal to generate the 70 MHz IF signal. This signal is amplified by a gain-controlled 70 MHz IF amplifier and routed to the Equalizer/70 MHz IF Amplifier A5.

The selection of the desired channel may be made locally using the front panel channel select switch or remotely using a compatible control device; see paragraph 3-4, Section III. In either case, the selection is made through a BCD coded channel select switch. The BCD signal is decoded in the tuner to develop a dc voltage whose level is proportional to the selected channel. This voltage is processed by shaping circuits to generate the tuning voltage for the local oscillator and the preselector.

In the Equalizer/70 MHz IF Amplifier Module A5, an equalizer network processes the IF signal to provide the receiver with optimum phase linearity across the passband. The amplifier exhibits an overall gain of 35 dB with -0.5V agc and unity gain with -5V agc. From Module A5, the IF signal is coupled to the IF Amplifier A9 which exhibits an overall gain of approximately 15 dB with -0.5V agc and unity gain with -5V agc.

The passband (bandwidth) of the IF signal depends on the IF Amplifiers (A5 and A9) employed in the receiver. IF amplifiers having bandwidths of 17.5 MHz, 25 MHz, 30 MHz, 36 MHz, and 40 MHz are available.

The 70 MHz IF signal from the IF amplifier is routed to the FM Demodulator A4. In the demodulator module, the IF signal is limited and demodulated. The resultant video signal is amplified and outputted at J2 for application to the video amplifier. The demodulator also outputs a baseband output which is not terminated as it is not used in this receiver.

The FM demodulator also generates the agc sensor voltage for the agc amplifier. The 70 MHz IF signal is amplified and then detected to provide this dc voltage that is proportional to the signal level.

The AGC Amplifier A2, is driven by the agc sensor output of the FM demodulator in the AGC mode and by the dc voltage set by the manual gain control in the MANual mode. The receiver employs the standard Microdyne 101-938 agc amplifier; however, the cor amplifier is not used. The agc amplifier controls the gain of the rf tuner and the gain of the IF amplifiers. The agc amplifier also drives the front panel meter. This meter, when in the SIGnal mode, will indicate the relative signal level as referenced to the agc voltage.

The De-Emphasis/Video Amplifier A10 processes the composite video signal from the FM demodulator. The de-emphasis/video amplifier provides a dual function. It contains a de-emphasis network which functions to compensate for, or offsets the effect of, the pre-emphasis network located in the system's transponder. The module also provides amplification for the pre-emphasis video signal. The module outputs a composite video signal for driving the audio subcarrier discriminator and a composite video signal for driving the clamper.

The Clamper A11 accepts the composite video signal from the video amplifier and functions to clamp the 30 Hz energy dispersing signal present on the video signal. This triangular signal is superimposed (FM) on the transmitted CW TV signal to disperse the signal so as to minimize interference with adjacent communications. The output of the clamper is coupled through the video filter to the rear panel connector J2 as the video output of the receiver.

The audio subcarrier output of Video Amplifier A10 is applied to the Audio Subcarrier Discriminator A6. This signal is in actuality a composite video signal. In the audio subcarrier discriminator, the selected audio subcarrier is extracted from the video signal, limited, and then the audio information is removed from the subcarrier. The subcarrier extracted depends on the discriminator employed in the receiver. Discriminators are available with subcarrier frequencies of 6.2 MHz, 6.8 MHz, and 7.5 MHz. The audio signal is routed through a 75 μsec de-emphasis network to offset the pre-emphais network in the system's transponder. The audio signal is coupled across the front panel audio gain control which permits setting the audio output level between 0 volts and +10 dBm. The output of the audio discriminator is made available at connector TB1 (pins 1 and 3) on the rear panel of the receiver. Each output, pin 1 and 3, has an impedance of 300 ohms resulting in a 600 ohm balance line audio output.

4-2.1 POWER SUPPLY

The power supply is composed of the main supply circuitry mounted on the chassis and the Voltage Regulator Board A1.

Primary power of 115V ac or 230V ac is coupled to the power transformer T2 through power switch S1 and line filters (C5-C10, L1-L4). The connections to the primary of T1 (pins 1 through 4) depend on the line voltage; see figure 2-2. In the power transformer, the primary input is stepped down to provide outputs to CR1, CR2, and CR3.

The positive output of rectifier CR2 is applied to the +15 volt regulator U1 and the negative output of CR2 is applied to the -15 volt regulator U2. The adjustment controls for these regulators are located on the Regulator Board A1; see figure 7-3. The outputs of these regulators are routed to the various receiver modules requiring these operating voltages.

The output of CR1 is the +70V used by the rf tuner as the control voltage for the tuned stages. This is an unregulated voltage and will vary with the line voltage.

CR3 outputs +14V dc which is applied to Regulator Board A1. On the board, the unregulated 14 volts is applied to A1U1 which outputs a regulated +5 volts. The board also contains two 6 volt regulators, A1U2 and A1U3, which take the +15V and -15V outputs of the main chassis regulators, U1 and U2, and provide the +6V and -6V regulated voltages.

The power supply voltages may be monitored using the front panel meter. The 70V indication on the meter should be used only as a reference as the voltage level will vary with the line voltage.

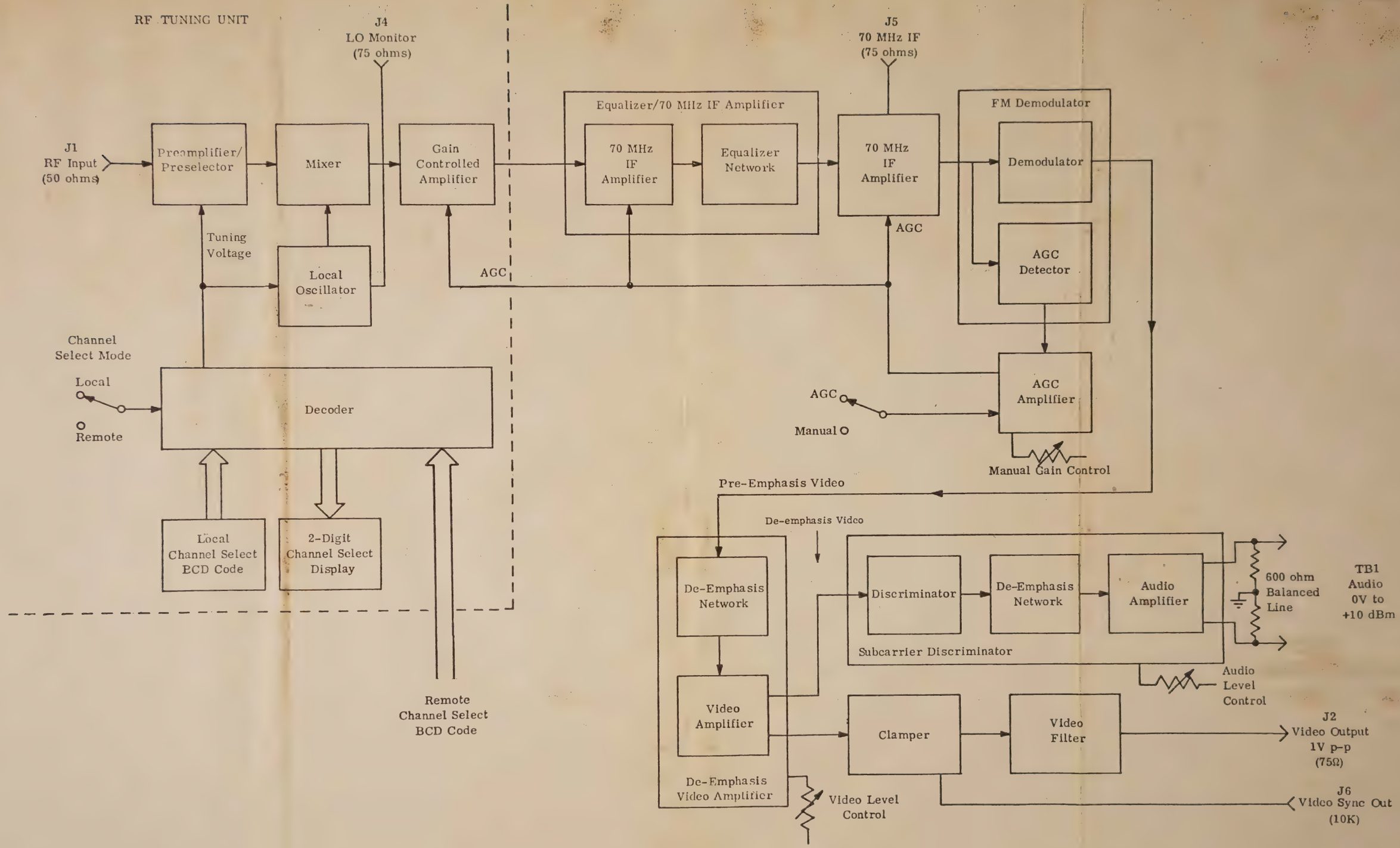


Figure 4-1. Functional Block Diagram

SECTION V
MAINTENANCE

5-1 GENERAL

This section contains the information and instructions concerning preventive and corrective maintenanee for the 1100-TVR(VT) Receiver. Troubleshooting and repair of the receiver should be attempted only by personnel experienced with similar equipment and having suitable test equipment. If these are not available, the factory should be consulted for maintenance support.

The 1100-TVR(VT) is serviced on two levels: a) on the equipment level where the maintenance tasks are performed on the overall receiver, considering the modules and subassemblies as replaceable parts; and b) on the module level where the individual modules and subassemblies are independently serviced. The maintenance tasks in this section are limited to those pertaining to the overall receiver; consult the instruction booklets for maintenance data on the modules.

A list of the recommended test equipment required to service and maintain the 1100-TVR(VT) is given in table 5-1. If the recommended equipment is not available, other equipment having equivalent specifications may be used. The equipment list may not agree with the required test equipment listed under the troubleshooting and alignment/adjustment procedures in the module instruction booklets as equivalent equipment has been deleted from the list.

5-2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of checks and adjustments done on a regularly scheduled basis and designed to detect and correct any performance or physical deterioration. The design of the 1100-TVR(VT) eliminates the need for any extensive preventive maintenance. Preventive maintenance for the receiver is limited to a visual inspection and a performance test.

5-2.1 VISUAL INSPECTION

A visual inspection of the receiver should be performed at monthly intervals to prevent possible malfunctions caused by a mechanical fault or failure. The inspection should include but is not limited to the following checks:

a. Rear apron connectors for corrosion, looseness, and damaged or loose contacts.

b. Internal wiring for cut, cracked, and frayed insulation, and nuts and bolts for looseness.

c. Solder joints for crystallization and corrosions.

d. Switches and internal connectors for loose connections and corrosion.

e. Resistors and wiring for discoloration and other evidence of overheating.

f. Dust and dirt accumulation. If dusty, blow out the receiver chassis using low pressure air.

g. Front panel for scratches and bare spots.

All loose hardware should be tightened immediately. Damaged and corroded switches and connectors should be replaced. Overheated resistors and wiring should be replaced only after determining the cause of overheating. Scratches and bare spots on the front panel should be covered using a matching touchup paint.

5-2.2 LUBRICATION

There are no lubrication requirements for the receiver.

Table 5-1. Recommended Test Equipment

RMS Voltmeter	HP3400A
Digital Voltmeter	Fluke 8000A
RF Millivoltmeter	HP411
NTSC Signal Generator	Tektronix 149A
Signal Generator	TS-403B/U
Signal Generators	HP608, HP8616A, HP8614
Sweep Generators	Texscan VS-50, HP8620, Wavetek 2001
Vectorscope	Tektronix 520A
Waveform Monitor	Tektronix 529A
Oscilloscopes	HP1201AR, Tektronix T932
RF Detector	HP8471A
Step Attenuators	HP355D, HP355C
Attenuator	Weinschel 9043-1, CODECO D511
Frequency Counters	HP5246L/5254B/5253B
Test Oscillator	HP651A
FM Generator/Univerter	Boonton 202J/202H
Modulator	Microdyne
Directional Couplers	HP776D, HP777D
Noise Figure Meter	HP340B
Noise Source	HP349A
Power Meter	HP431C
Extender Card	Microdyne 300-423
Amplifier	HP8447D
4.2 MHz LP Filter 10 kHz HP Filter Weighting Network	Per C.C.I.R. Recommendation

5-2.3 PERFORMANCE TEST

At six-month intervals and after any repairs, the following tests should be conducted. These tests are designed to check the overall performance of the receiver.

Power Supply

a. Remove all modules, including the AGC amplifier board from the receiver; see paragraph 5-3.2 for instructions.

b. Apply power to the receiver. Connect a DC voltmeter to the +15 volt test point E2 and adjust R1 for an exact +15.00V DC indication on the voltmeter. R1 and R2 are located on the regulator board.

c. Connect the voltmeter to the -15 volt test point E6 and adjust R2 for an exact -15.00 DC indication on the voltmeter.

d. Connect the voltmeter to the -6 volt test point E8; the voltmeter should indicate -6(±0.25)V DC. Connect the voltmeter to the +6 volt test point E4; the voltmeter should indicate +6(±0.25)V DC.

AGC Amplifier

e. Plug in the AGC amplifier board. Place the AGC/MAN switch in the MAN position. Connect the DC voltmeter to the AGC test point, E26.

f. Adjust the manual GAIN control and note that the agc voltage (as indicated on the voltmeter) varies from 0.00V DC to -5.00V DC. Set the GAIN control for an agc voltage of -3.5V DC.

g. Place the AGC/MAN switch in the AGC position. Connect an oscilloscope to the AGC line at E26. Note that all AC voltage levels are below 50 mV peak-to-peak. Disconnect the test equipment.

IF Amplifier Response

h. Install the IF amplifier/equalizer module A5, and the IF amplifier module A9. Do not connect the receiver cabling to J1 of A5 and to J2 of A9.

i. Set up the test equipment to conduct a sweep response of the amplifiers; if necessary, see the instruction booklets for the amplifiers for details.

j. Note that the amplitude response is a slightly overcoupled 36 MHz, 3 dB response. If not, recheck the alignment of the modules using the procedures given in the instruction booklets.

k. Disconnect the test equipment and connect the receiver cabling to J1 of A5 and J2 of A9.

Unity Signal-to-Noise

l. Install the remaining modules in the receiver.

m. Set the tuner to channel 23. Set the AGC/MAN switch to MANual and adjust the GAIN control to produce approximately -2.5V AGC at E26.

n. Set an HP8616A generator to 4160 MHz, CW, with the output attenuator set to 50 dB calibrated. Connect the HP8616A to the rf input, J1.

o. Connect a frequency counter to the IF monitor output, J4 of IF amplifier A9. Increase the HP8616A attenuator until the counter functions. Adjust the HP8616A until the counter indicates 70 MHz. Set the HP8616A attenuator for minimum rf output.

p. Disconnect the counter and connect an HP411 voltmeter, loaded with 75 ohms, to the IF monitor output, A9J4. Adjust the manual GAIN control until the HP411 indicates -20 dBm. Connect a 3 dB, 75 ohm pad in series with the HP411.

q. Slowly increase the output of the HP8616A until the HP411 again indicates exactly -20 dBm. Note the calibrated attenuator on the HP8616A reads between 86 and 90 dB. If not, repeat steps o through q.

r. Repeat steps m through q for any desired channel. Disconnect the test equipment.

AGC Signal Level Meter Adjustment

s. Set the AGC/MAN switch to AGC. Set the meter function switch to SIG. Monitor the AGC voltage at E26. This is the AGC voltage level on noise.

t. Adjust the AGC ZERO control (on the power supply deck), until the meter indicates 0.

u. Set the AGC switch to MANual. Adjust the GAIN control until the AGC voltage is -5.00V DC at E26.

v. Adjust the 60 dB control until the meter indicates full scale.

w. Reset the AGC/MAN switch to AGC and note the meter still indicates 0.

De-Emphasis Adjustment

x. Connect the receiver and test equipment as shown in figure 5-1. Set up the test equipment as indicated on the next page.

TS 403B/U Signal Generator

Mode - CW
Output Level - Maximum (Ensure output level does not cause overloading problem in FM modulator.)
Frequency - 2500 to 2600 MHz, as required

Type 529 Waveform Monitor

Response - Flat
DC Restorer - ON
Input - AC Coupled; A position
Volts Full Scale - 1.0
Cal - Full Scale
Sync - Internal
Magnifier - X1
Line Selector - 18
Field - One/even
Display - 525/60
Line and Field Rate - 1 line

520A NTSC Vectorscope

Switches Depressed	Channel A	Ø Ref
Ch A	Max. Gain Position	Burst Position
Full Field		
A Ø		

149 NTSC Test Signal Generator

Program Control	Color Test Signal	Multi-Burst
Unity Gain	Color Bars	60 IRE
Program	Split Field	
Remote		

Linearity	APL	Full Field Signal
Subcarrier ON	Variable	Switch as required
	100% APL	

D511 Attenuator 75 ohms - 2.9 dB

Weinschel Attenuator - As Required

Microdyne Modulator - Pre-Emphasis In

5381A 80 MHz Counter - Gate Time - .15
Attenuator - X1

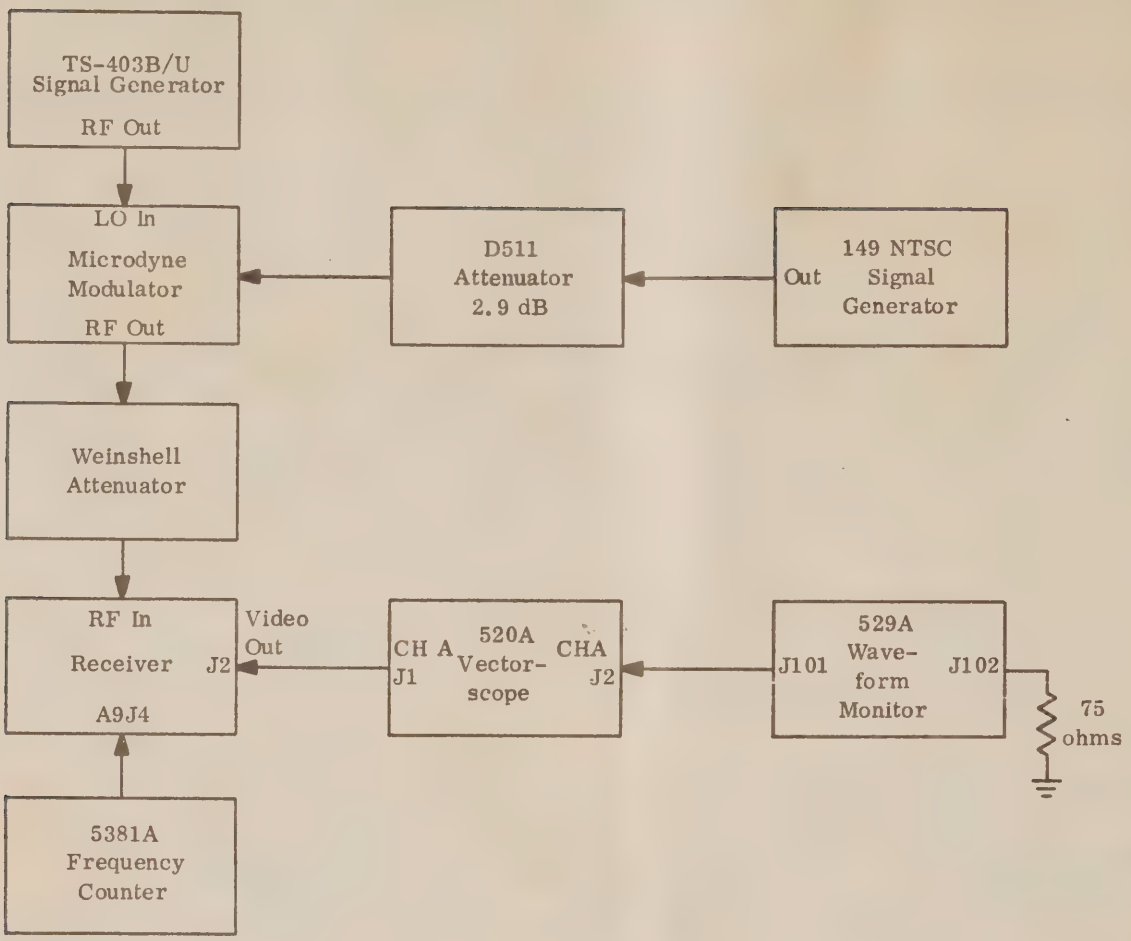


Figure 5-1. De-Emphasis Adjustment Test Equipment Setup

y. Set the receiver to Channel 23 and the 149 test signal generator Full Field Signal to Composite. Set the Weinschel attenuator to -10 dB on the outside scale. Connect the 5381A 80 MHz counter to J4 of IF Amplifier A9, the IF monitor output. Disconnect the cable from the output of the 149 generator.

z. Set the TS-403B/U generator to about 2610 MHz. The AGC should increase and the counter should operate. Adjust the frequency of the TS-403B/U until the counter indicates 70 MHz.

aa. Reconnect the cable to the output of the 149 generator and note a waveform is present on the 529 waveform monitor.

ab. Adjust the front panel video level until the waveform extends the full 140 IRE units.

ac. Adjust the Weinschel attenuator until the AGC voltage is approximately -4.8V DC.

ad. Disengage the quarter-turn fasteners on the De-Emphasis Module A10. Lift it up from the chassis and position it so access to the module can be obtained. Do not disconnect any cabling. Adjust the adjustable coil. L1, for best square wave of the composite signal obtained in step ab. The adjustment affects the rise time and fall time of the white large square wave in the waveform. Adjust the coil to make this square wave as square as possible at the top of the leading and the bottom of the falling edge.

70 MHz FM Demodulator Alignment

ae. The demodulator is adjusted for three parameters: Differential Phase, Differential Gain, and Signal-to-Noise vs. Carrier-to-Noise ratios. Set 149 Full Field Signal to Linearity position. Increase the RF level until the AGC is -4.7V DC.

af. Monitor the 520A Vectorscope. Depress the (Vector - Set VIRS to I Ø) push-button switch. Note the circular display shows single trace horizontal lines from the center to the outer left hand part of the circle. Adjust the Channel A Gain CAL thumbwheel control until the trace extends from the center just to the outer edge.

ag. Disconnect the cable from the 149 test generator and note the counter indicates 70.0 MHz; if not, readjust the TS-403B/U signal generator. Reconnect the cable to the 149. Adjust the Calibrated Phase control to read 0°.

ah. Differential Phase Measurement:

(1) Depress the Diff Phase switch and note the waveform. Adjust the Channel A phase control knob and note that the waveform has two traces. Adjust the phase control until the two traces converge over one another at the far left.

(2) Note that the first step on each trace is converged over one another. After adjusting the phase control to converge the first steps, rotate the Calibrated Phase Control knob until the most widely separated steps converge. Read the differential phase from the calibrated phase window.

ai. Differential Gain Measurement:

Depress the Diff Gain switch and, using the screwdriver Vert position adjustment, adjust the trace until the left-hand side of the trace lines up with the 0 line at the center of the CRT. The Differential Gain distortion is read on the right-hand side of the trace within the ±10% range. The distortion is read directly as 2%, 4%, etc.

Demodulator Alignment:

(1) Set up the test equipment as for Differential Phase measurement, step ah. Note the Differential Phase error is less than ±1%; if not, adjust L14, L15. There is interaction between the coils so rock back and forth between adjustments.

(2) Switch the unit for Differential Gain measurements and note the Differential Gain distortion. Adjustment is accomplished with the coils already mentioned. The alignment requires the adjustment of these coils.

(3) Switch the Full Field Signal from Linearity to Multiburst and refer to the waveform monitor for the multiburst response. The response should be flat for all frequencies displayed ±0.5 divisions.

(4) The adjustment of the demodulator coils also affects the multiburst response. Reset Full Field Signal to Linearity for Differential Phase and Differential Gain measurements.

Signal-to-Noise vs. Carrier-to-Noise

ak. Set up the receiver for Channel 23. Note the Video Level is still 140 IRE units. If not, adjust the Video Gain control. Disconnect the cable from the 149 generator and note the counter indicates 70.0 MHz.

al. Remove the counter from the IF monitor (J4 of A9) and connect an HP411 milli-voltmeter, loaded with 75 ohms to this connector.

am. Adjust the Weinschel attenuator for maximum attenuation. Set the AGC switch to Manual and adjust the GAIN control until the HP411 indicates -15 dBm.

an. Insert a 3 dB, 75 ohm coax pad between the J4 of A9 and the HP411.

ao. Decrease the attenuation of the Weinschel pad until the HP411 indicates -15 dB again. Note the reading on the pad, this is unity carrier-to-noise ratio.

ap. Connect the 4.3 MHz Low Pass Filter/Weighting Network and High Pass Filter in series. Connect the input of the 4.2 MHz LPF to the receiver video output, J2, and the high pass output to a 3400 RMS meter. Set the receiver AGC switch to AGC mode.

aq. Set up the receiver for 8 dB carrier-to-noise ratio by decreasing the attenuation of the Weinschel pad 8 dB below the setting of step ao. Note the -44 dB minimum on the 3400 RMS meter.

ar. Decrease the pad 15 dB from the reading in step ao and note the signal-to-noise ratio, -53 dB minimum on the HP3400.

as. Decrease the pad 30 dB and note the signal-to-noise is indicated on the HP3400 as -63 dB minimum.

at. If the receiver will not meet the above, check for poor grounds on the equipment and if necessary, slightly adjust L14 and L15 of the 70 MHz Demodulator, checking the Differential Phase and Differential Gain.

Audio Subcarrier Test

au. Set up the Boonton FM signal generator and Boonton univerter to produce 6.8 MHz FM modulated at a 1 kHz rate with 75 kHz deviation.

av. Set the receiver AGC Mode switch to AGC. Replace the filters from the video output with the waveform monitor. Connect the video modulation cable back to 403 signal generator and set up the unit for multiburst display.

aw. Connect the output of the Boonton set to -15 dBm to the AUX input of the Microdyne Modulator, loaded with 50 ohms at the modulator input.

ax. Adjust the Audio Gain control on the receiver front panel fully clockwise.

ay. Connect an oscilloscope loaded with a 300 ohm across the audio output terminals at the rear of the receiver. The output level as measured from the center to the terminal on either side of the strip should be 2.0V p-p, at 1 kHz.

This completes the tests. Remove power from the receiver, disconnect the test equipment, and replace the receiver in the system.

5-3 CORRECTIVE MAINTENANCE

The corrective maintenance for the 1100-TVR(VT) Receiver consists of troubleshooting, repair and replacement, and alignment/adjustments. Information pertaining to these subjects is given in the following paragraphs.

5-3.1 TROUBLESHOOTING

As with any other electronic equipment, knowledge of the operating parameters and theory of operation are prerequisites to troubleshooting. The troubleshooting procedure should follow a logical process of elimination based on the observed symptoms; e.g., erroneous meter indications, absence of outputs, effect that controls have or do not have, etc.

Prior to troubleshooting the internal circuitry, a check should be made to ensure that all connections between the receiver and associated equipment are correct and that the fuse is not blown. If the fuse is blown, the fault is most likely to be within the power supply and that section should be checked accordingly; shorted rectifiers, diodes, and capacitors are easily detected using an ohmmeter.

Test points, which are accessible with the safety shield in place, have been incorporated into the power deck to permit checking the power supply. If the voltage at a test point is absent, or low, etc., check the power supply circuitry associated with this output. The 70V output is referenced to a 115V line voltage and a higher or lower line voltage will cause a corresponding change in this output, but will not affect the operation of the receiver.

5-3.1.1 FAULT ISOLATION. After the power supply and cabling have been checked as discussed in the preceding paragraph, an attempt should be made to isolate the fault to a specific module. This can usually be done by noting the symptoms and recognizing which modules are associated with the symptoms. The signal level and/or frequency at the output of each functional module can also be checked. Table 5-2, module output signal levels, may be used as a reference when making this check. When the malfunction has been isolated to a module, the module can be replaced or repaired following the instructions given in the instruction booklet for same.

During test and/or maintenance, it may be desirable to remotely select the channels from a remote source. Refer to paragraph 3-4 in Section III for details.

5-3.2 REPAIR AND REPLACEMENT INSTRUCTIONS

The recommended assembly/disassembly and repair procedures for the 1100-TVR(VT) Receiver are given in the following paragraphs. No special tools are required to repair the receiver. To gain access to the interior of the chassis, remove the top and bottom covers. A Module Location Drawing is provided in figure 5-2.

5-3.2.1 ASSEMBLY/DISASSEMBLY

a. Metal Encased Modules
These modules are removed by first disconnecting the cabling, then releasing the quarter-turn fasteners and lifting out the module.

b. RF Tuner
The four front panel screws holding the tuner in place must be removed. Remove the mounting nut on the LOCAL/REMOTE switch. Remove the two screws in the tuner rear connector bracket. Disconnect the cabling and lift out the tuner.

c. AGC Amplifier
The AGC amplifier is in the form of a plug-in printed circuit board and is installed or removed from the bottom of the chassis.

d. Power Supply Deck
This assembly contains the power supply components and the internal setup calibration controls. The plastic shield on the deck is a safety device and should be replaced if for any reason it is removed for maintenance purposes.

The transformer is held in place by four screws accessible from the top of the chassis. When released, the transformer will drop and is removed from the bottom of the chassis.

Table 5-2. Signal Level Distribution

Module	Test Point	Measurement	Level	Notes
70 MHz IF/Equalizer	J1	IF input	--------	Not measurable without full system data.
70 MHz IF/Equalizer	J2	IF output	--------	Varies with signal level. Unit gain 40 dB with 0V AGC.
70 MHz IF Amplifier	J1	IF input	--------	Level varies with signal level. Unit gain 20 dB with 0V AGC.
70 MHz IF Amplifier	J3	IF monitor	40 mV	Level measured with AGC loop closed, 70 MHz.
70 MHz IF Amplifier	J2	IF output	125 mV rms	Monitor AGC voltage with loop closed. Set to manual AGC. Adjust gain for the same voltage, then measure level, reset switch to AGC mode.
70 MHz FM Demodulator	J1	IF input	125 mV rms	Measure the same as J2 of the 70 MHz IF Amplifier.
70 MHz FM Demodulator	J2	Demod output	1.2V p-p	Color burst amplitude, pre-emphasized video.
70 MHz FM Demodulator	J3	Baseband output	1.2V p-p	Same as J2 of the Demodulator.
De-Emphasis Video Amplifier	J1	Video input	1.2V p-p	Same as J2 of the Demodulator.
De-Emphasis Video Amplifier	J2	Video output	.9V p-p	Horizontal blanking level, de-emphasized video.
De-Emphasis Video Amplifier	J3	Audio sub-carrier output	.8V p-p	Horizontal blanking level, de-emphasized video.
Audio Subcarrier Discriminator	J1	Video input	.8V p-p	Same as J3 of the De-Emphasis Video Amplifier.
Clamper	J1	Video input	0 to .7V p-p	Horizontal blanking level, de-emphasized video. Adjustable via front panel video gain.
Clamper	J2	Video output	0 to .4V p-p	Horizontal blanking level, de-emphasized video. Adjustable via front panel video gain.

*1) All measurements taken across a 75 ohm load and using coaxial cables. Signal level not measurable in the RF Tuner without full system data. 2) If a fault is suspected in the RF Tuner, the local oscillator may be checked by monitoring the output at J4, LO Monitor. Refer to the manual for the RF Tuner, Channel Center Frequency Check/Calibration procedures; an overall check of the tuner can be made by conducting the Gain and Gain Reduction Measurements. 3) The IF Monitor Output, J5, may be used to monitor the IF signal present in the IF Amplifier module.

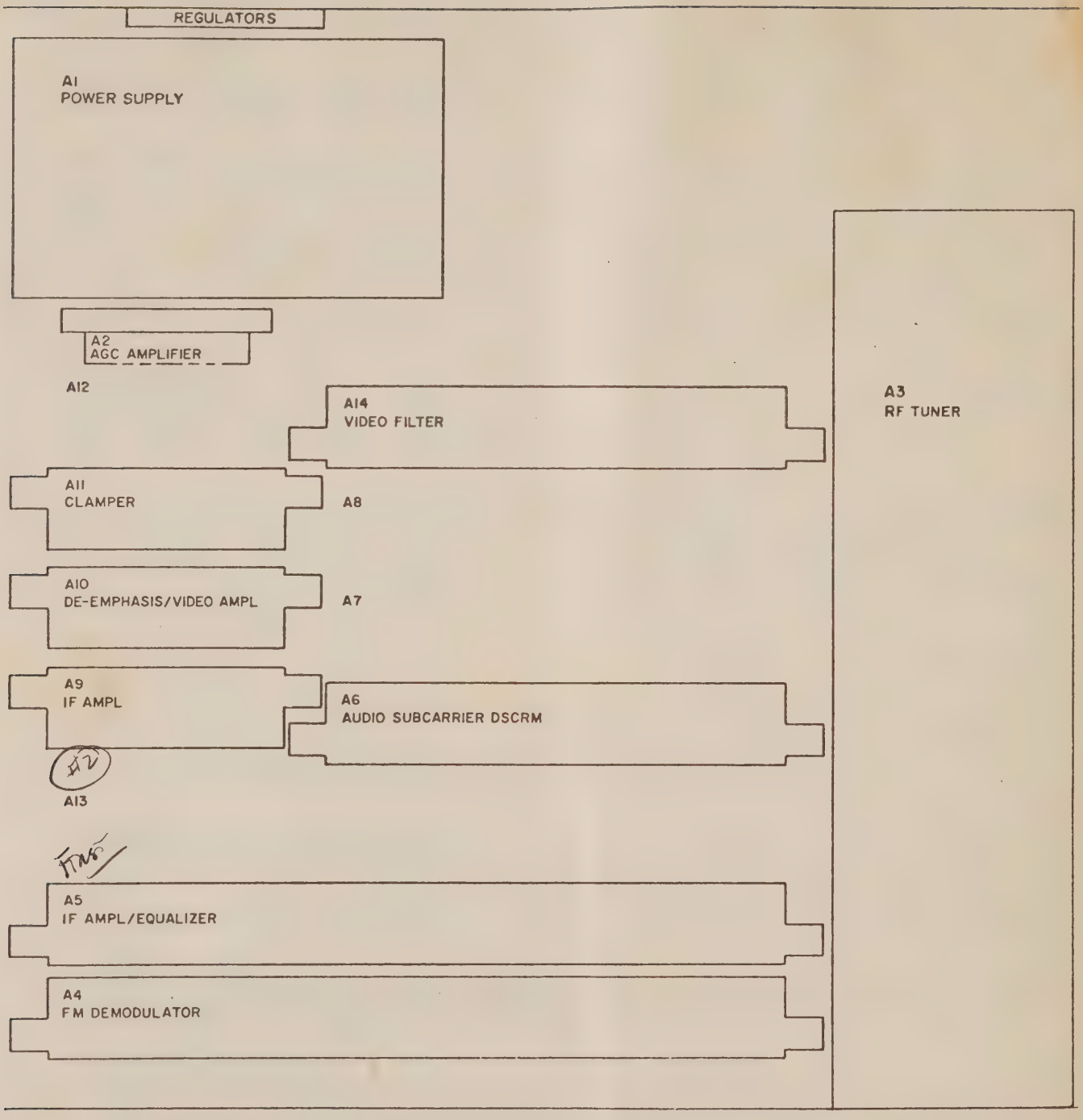


Figure 5-2. Module Location Drawing

To obtain access to the regulators and/or regulator board, remove the heat sink.

CAUTION

Use care when replacing or rewiring the +15V regulator and -15V regulator as a wiring error can cause the destruction of the regulators. Follow the wiring guides shown on the safety shield (+15V regulator) and on the bottom of the transformer (-15V regulator).

5-3.2.2 REPAIR PROCEDURES. A component location drawing for the voltage regulator printed circuit assembly is provided in figure 5-3 to aid in the physical identification of the components. Most of the hardwired components are identified by stenciled reference designations on the housing; stencils are not provided for those hardwired components easily identifiable. Identification of the terminals on the front panel is provided in figure 5-4.

a. Hardwired Components:

(1) Use a medium wattage soldering iron (45w).

(2) Special care must be taken when soldering near integrated circuits or other components to prevent damage.

(3) After completing repairs, clean flux from all terminals and solder points.

(4) Check all connections against the schematic diagrams before applying power.

b. Printed Circuit Boards:

Printed Circuit Boards used in the receiver have plated through holes, and the following procedure is recommended for component replacement.

(1) Gather the following material and tools:

Medium wattage (45w) soldering iron	Solder
Soldering aid	Soldering flux and flux remover
Diagonal pliers (small)	1/8 inch wire braid or solder sucker
Longnose pliers	

(2) Using the diagonal pliers, cut the component from the board leaving sufficient lead length for grasping with the longnose pliers.

(3) Dip the wire braid tip into the soldering flux and then place the braid over the soldered connection. Apply heat to the braid; it will absorb most of the solder. Apply heat directly to the connection and pull the lead from the board. Continue to clean the hole in the board using the flux and braid. If a solder sucker is used, simply heat the connection and use the sucker to remove the solder.

CAUTION

Exercise extreme care when heating the board. Excessive heat may damage the board beyond repair.

(4) Insert the replacement component and solder. Trim all leads and clean the area with flux remover.

(5) Remount the board in the chassis and connect all leads.

5-3.3 ALIGNMENT/ADJUSTMENTS

The only adjustments required for the 1100-TVR(VT) Receiver are those related to the operational setup calibration (paragraph 3-3, Section III) and the +15V and -15V power regulator (paragraph 5-2). The modules are independently aligned; no interface adjustments are necessary.

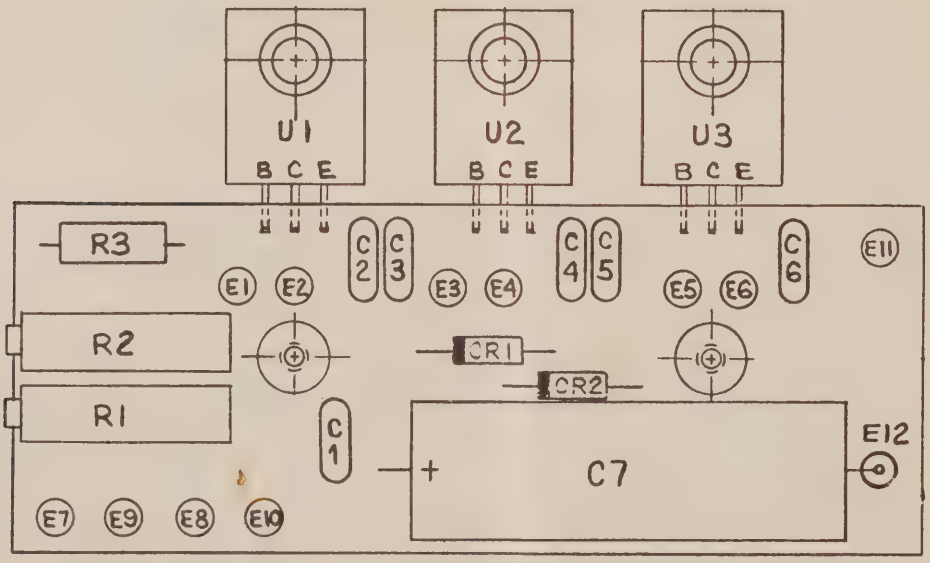


Figure 5-3. Regulator Board, Component Location Drawing

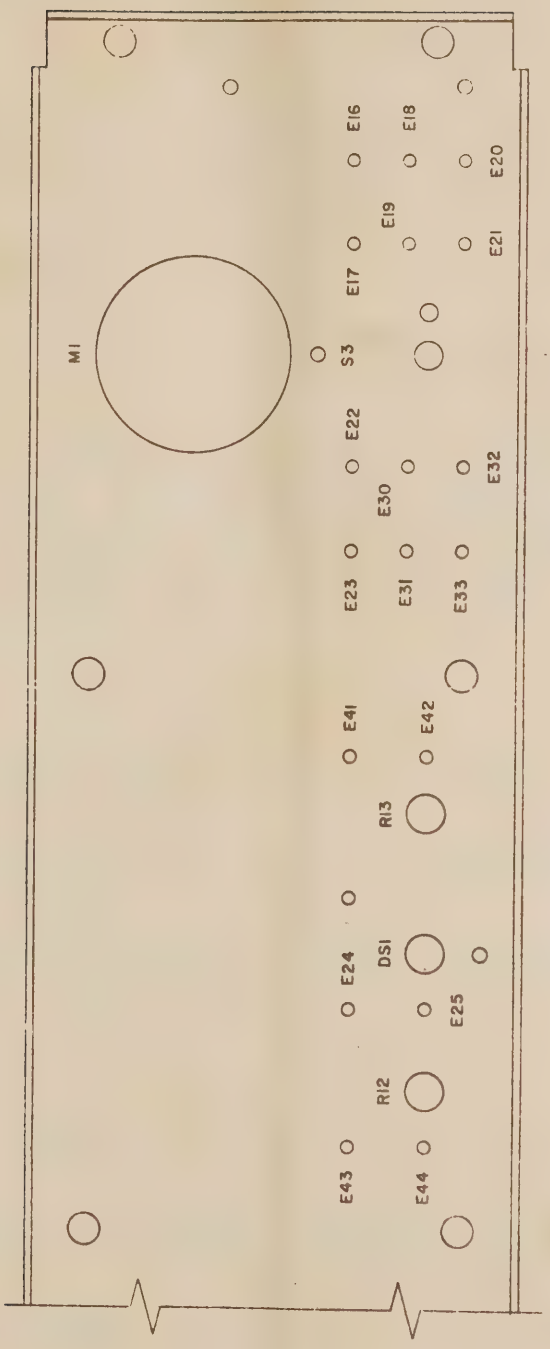


Figure 5-4. Front Panel Rear, Terminal Identification

SECTION VI
REPLACEABLE PARTS LIST

6-1 GENERAL

This section contains the replaceable parts list for the 1100-TVR(VT) Satellite/TV Receiver. Components are listed alphanumerically by subassembly and provide the reference designator, description, manufacturer, and manufacturer's part number. Include all information when ordering spare or replaceable components.

6-2 BASE CHASSIS

Reference Designation	Description
A1	Power Supply, Microdyne 103-204; see paragraph 6-3 for breakdown listing
A2	AGC Amplifier, Microdyne 101-938/4869; see instruction booklet 101-938
A3	RF Tuner, Microdyne 103-051; see instruction booklet 103-051
A4	FM Demodulator, Microdyne 101-994; see instruction booklet 101-994
A5	IF Amplifier/Equalizer, Microdyne 101-995; see instruction booklet 101-995
A6	Audio Subcarrier Discriminator, Microdyne 101-996; see instruction booklet 101-996
A7	Not Assigned
A8	Not Assigned
A9	IF Amplifier, Microdyne 101-997; see instruction booklet 101-997
A10	De-Emphasis Video Amplifier, Microdyne 101-998; see instruction booklet 101-998
A11	Clamper, Microdyne 101-999; see instruction booklet 101-999
A12	Not Assigned
A13	Not Assigned
A14	Video Filter, Microdyne 103-000; nonrepairable
DS1	Diode, LED (green), Hewlett Packard 5082-4955
E1 thru E15	Not Assigned
E16 thru E25	Termination, insulated, Cambion 4850-1-0516
E26 thru E29	Not Assigned
E30 thru E33	Termination, insulated, Cambion 4850-1-0516

Replaceable Parts List - Base Chassis, continued

Reference Designation	Description
E34 thru E39	Not Assigned
E40	Termination, insulated, Cambion 4812-1-0516
E41 thru E44	Termination, insulated, Cambion 4850-1-0516 (Spares)
F1	Fuse, 0.75 amp, Slo-Blo, Bus 3AG Slo-Blo 3/4 Amp
F2	Fuse, 0.75 amp (Spare), Bus 3AG Slo-Blo 3/4 Amp
J1	Connector, bulkhead jack, type N, p/o W1, Phelps Dodge 935-001
J2	Connector, bulkhead jack, type N, p/o W10, Bendix 30517-10
J3	Connector, Cambion DBM-25S
J4	Connector, bulkhead jack, type P, p/o W11, Bendix 30517-10
J5	Connector, bulkhead jack, type P, p/o W12, Bendix 30517-10
J6	Connector, bulkhead jack, type P, p/o W13, Bendix 30517-10
M1	Meter, signal level, Microdyne 203-226
P1	Connector, p/o W1, Phelps Dodge 522-004
P2	Connector, p/o W2, OSM 531-3A
P3	Connector, 25 pin, AMP 205-207-1
P4	Connector, 9 pin, AMP 205-203-1
P5	Connector, 9 pin, AMP 205-203-1
P6	Connector, 9 pin, AMP 205-203-1
P7	Connector, p/o W2, Phelps Dodge 700-233
P8	Connector, p/o W3, Phelps Dodge 700-233
P9	Connector, 9 pin, AMP 205-203-1
P10	Connector, 9 pin, AMP 205-203-1
P11	Connector, 9 pin, AMP 205-203-1
P12	Connector, p/o W3, Phelps Dodge 700-233
P13	Connector, p/o W4, Phelps Dodge 700-233
P14	Connector, 9 pin, Phelps Dodge 700-233
P15	Connector, p/o W5, Phelps Dodge 700-233
P16	Connector, p/o W5, Phelps Dodge 700-233
P17	Connector, p/o W6, Phelps Dodge 700-233
P18	Connector, p/o W6, Phelps Dodge 700-233
P19	Connector, p/o W7, Phelps Dodge 700-233
P20	Connector, p/o W8, Phelps Dodge 700-233
P21	Connector, p/o W9, Phelps Dodge 700-233
P22	Connector, p/o W9, Bendix 30220-112

Replaceable Parts List - Base Chassis, continued

Reference Designation	Description
P23	Connector, p/o W10, Bendix 30220-112
P24	Connector, p/o W12, Phelps Dodge 700-233
P25	Connector, p/o W11, UG1465/U
P26	Connector, p/o W13, Phelps Dodge 700-233
R1 thru R5	Not Assigned
R6	Resistor, metal film, 76.8KΩ ±1%, IRC RN60D7682F, nominal value
R7	Resistor, metal film, 191KΩ ±1%, IRC RN60D1913F, nominal value
R8	Resistor, metal film, 76.8KΩ ±1%, IRC RN60D7682F, nominal value
R9	Resistor, metal film, 191KΩ ±1%, IRC RN60D1913F, nominal value
R10	Resistor, fixed composition, 620Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6215
R11	Not Assigned
R12	Potentiometer, 1.0KΩ, Beckman 89PBR1K
R13	Potentiometer, 100Ω, Beckman 89PBR100
R14	Factory selected
R15	Factory selected
R16	Factory selected
R17	Factory selected
R18	Not Assigned
R19	Resistor, metal film, 64.9KΩ ±1%, IRC RN60D6492F, nominal value
R20	Factory selected
R21	Resistor, metal film, 953KΩ ±1%, IRC RN60D9533F, nominal value
R22	Factory selected
S1	Switch, DPDT, C&K 7201 w/dress nut and red cap
S2	Not Assigned
S3	Switch, 2P7T, Microdyne 203-227
TB1	Terminal Block, Cinch 3140-Y
W1	Cable Assembly, Microdyne 203-329
W2	Cable Assembly, Microdyne 203-327-76
W3	Cable Assembly, Microdyne 203-228-41
W4	Cable Assembly, Microdyne 203-228-39
W5	Cable Assembly, Microdyne 203-228-52
W6	Cable Assembly, Microdyne 203-228-41
W7	Cable Assembly, Microdyne 203-333-53
W8	Cable Assembly, Microdyne 203-333-57
W9	Cable Assembly, Microdyne 203-328-33
W10	Cable Assembly, Microdyne 203-330-45

Replaceable Parts List - Base Chassis, continued

Reference Designation	Description
W11	Cable Assembly, Microdyne 203-426-33
W12	Cable Assembly, Microdyne 203-331-43
W13	Cable Assembly, Microdyne 203-331-41
XA1	Not Assigned
XA2	Connector, Microdyne 201-256-1
XF1	Fuse Holder, Littelfuse 342004
XF2	Fuse Holder, Littelfuse 342004

6-3 A1, POWER SUPPLY

Reference Designation	Description
A1	Voltage Regulator, Microdyne 101-993; see paragraph 6-3.1 for breakdown listing
C1	Capacitor, electrolytic, 5200 μF, 50V, GE GE86F1476
C2	Capacitor, electrolytic, 5200 μF, 50V, GE GE86F1476
C3	Capacitor, tantalum, 100 μF, 25V, MIL-C-3965, CL65BG101MP3
C4	Capacitor, tantalum, 100 μF, 25V, MIL-C-3965, CL65BG101MP3
C5	Capacitor, ceramic, 1000 pF, 1000V, Sprague 5GA-D10
C6	Capacitor, ceramic, 220 pF, 1000V, Sprague 5GA-T22
C7	Capacitor, ceramic, 1000 pF, 1000V, Sprague 5GA-D10
C8	Capacitor, ceramic, 1000 pF, 1000V, Sprague 5GA-D10
C9	Capacitor, ceramic, 220 pF, 1000V, Sprague 5GA-T22
C10	Capacitor, ceramic, 1000 pF, 1000V, Sprague 5GA-D10
C11	Capacitor, electrolytic, 30 pF, 100V, Sprague TE1411
C12	Capacitor, electrolytic, 30 μF, 100V, Sprague TE1411
C13 thru C15	Capacitor, tantalum, 100 μF, 20V, Kemet T362D107M020AS
CR1 thru CR3	Rectifier, silicon bridge, Semtech SCAJ2
CR4	Diode, 1N914

Replaceable Parts List - A1, Power Supply, continued

Reference Designation	Description
E1 thru E37	Termination, insulated, Cambion 4812-1-0516
E38	Termination, ground, Penn ST-125-t-ET
E39	Termination, insulated, Cambion 4812-1-0516
L1	Inductor, fixed, 1.0 μH, ±5%, Jeffers 4425-6
L2	Inductor, fixed, 0.22 μH, ±5%, Jeffers 4415-2
L3	Inductor, fixed, 1.0 μH, ±5%, Jeffers 4425-6
L4	Inductor, fixed, 0.22 μH, ±5%, Jeffers 4415-2
R1	Resistor, fixed composition, 3.3KΩ ±5%, 1/2w, Allen Bradley EB3325
R2	Resistor, fixed composition, 3.3KΩ ±5%, 1/2w, Allen Bradley EB3325
R3	Potentiometer, 25KΩ, Beckman 89PBR25K
R4	Potentiometer, 10KΩ, Beckman 89PBR10K
R5	Potentiometer, 50KΩ, Beckman 89PBR50K
R6 thru R10	Not Assigned
R11	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R12 thru R17	Not Assigned
R18	Resistor, fixed composition, 200KΩ ±5%, 1/2w, Allen Bradley EB2045
R19 thru R22	Not Assigned
R23	Resistor, fixed composition, 24KΩ ±5%, ¼w, Allen Bradley CB2435
S1	Not Assigned
S2	Switch, DPDT, C&K 7201
T1	Transformer, power, Microdyne 301-555
U1	Regulator, hybrid +15 volts, Lambda LAS-2215
U2	Regulator, hybrid -15 volts, Lambda LAS-2915

Replaceable Parts List, continued

6-3.1 A1A1, VOLTAGE REGULATOR BOARD

Reference Designation	Description
C1	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C2	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C3	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C4	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C5	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C6	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C7	Capacitor, electrolytic, 800 μF, 16V, Sprague TVA-1162-3
CR1	Diode, 1N4001
CR2	Diode, 1N4001
E1 thru E11	Termination, turret, Cambion 2027-2
E12	Termination, standoff, teflon, Sealectro ST-SM-1
R1	Potentiometer, 15KΩ, Beckman 89WR15K
R2	Potentiometer, 15KΩ, Beckman 89WR15K
R3	Resistor, fixed composition, 3.3KΩ ±5%, 1/2w, Allen Bradley EB3325
U1	Voltage Regulator, +5V, Motorola MC7805CP
U2	Voltage Regulator, +6V, Motorola MC7806CP
U3	Voltage Regulator, -6V, Motorola MC7906CP

SECTION VII
MAINTENANCE DRAWINGS

7-1 INTRODUCTION

This section of the manual contains the schematic-wiring diagram for the main chassis and for the regulator board. Schematic diagrams for the modular subassemblies are provided in the instruction booklets for same.

Unless otherwise specified, the following information applies to each schematic diagram:

a. Capacitor values greater than 1.0 are in picofarads.

b. Capacitor values less than 1.0 are in microfarads.

c. Inductor values are in microhenrys.

d. Resistor values are in ohms: k = x 1000; m = x 1,000,000.

e. * denotes selected value.

f. ferrite bead.

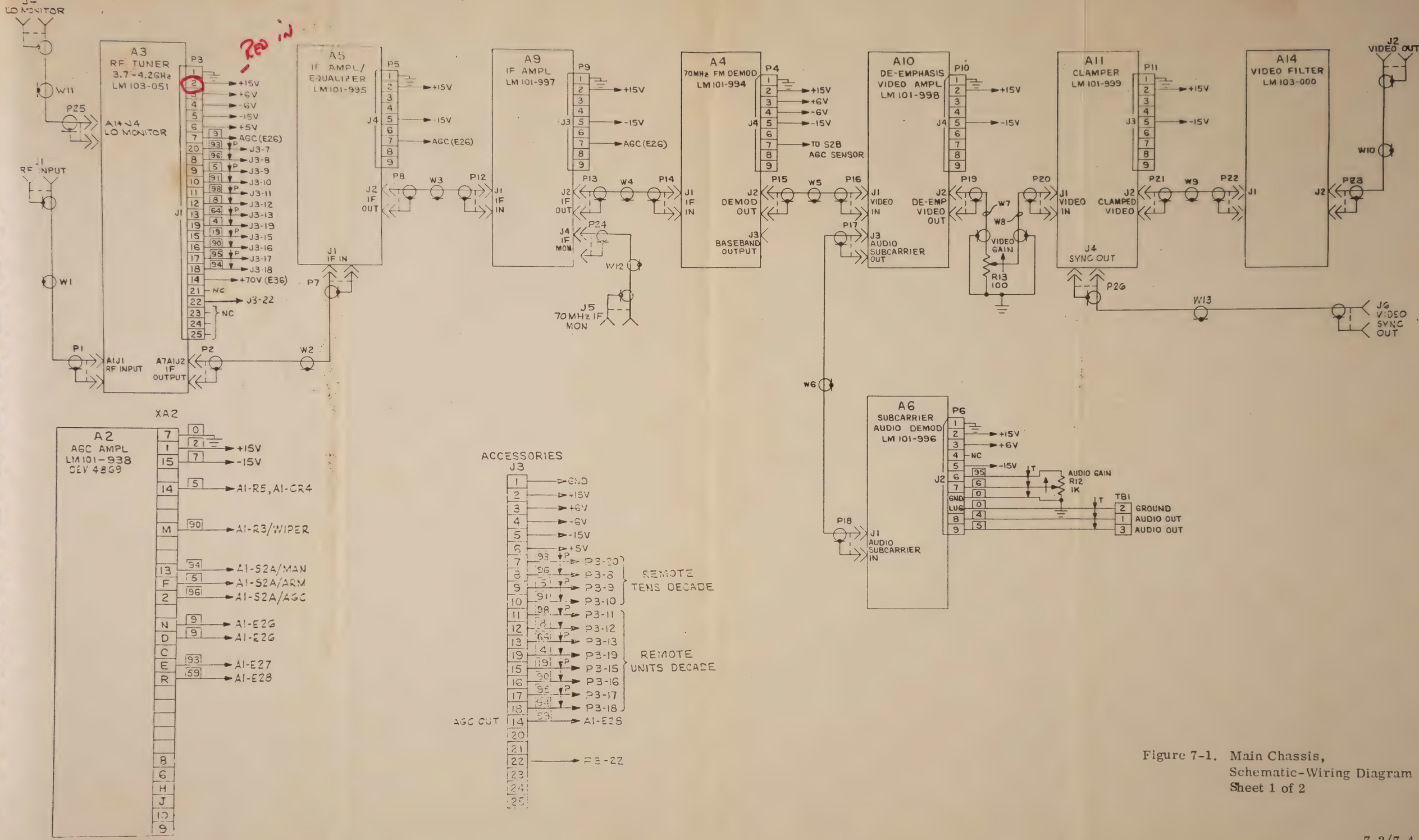


Figure 7-1. Main Chassis, Schematic-Wiring Diagram Sheet 1 of 2

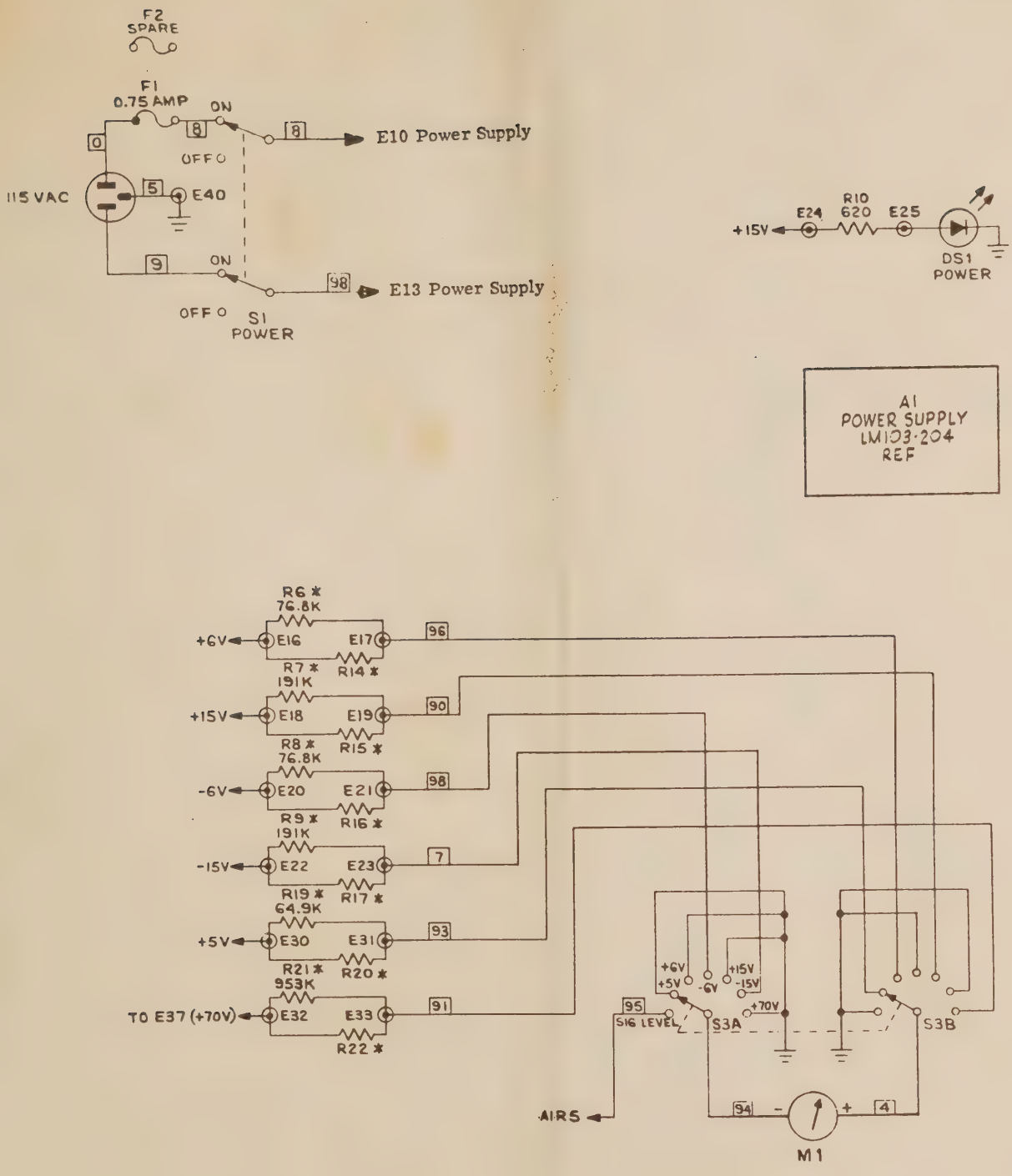
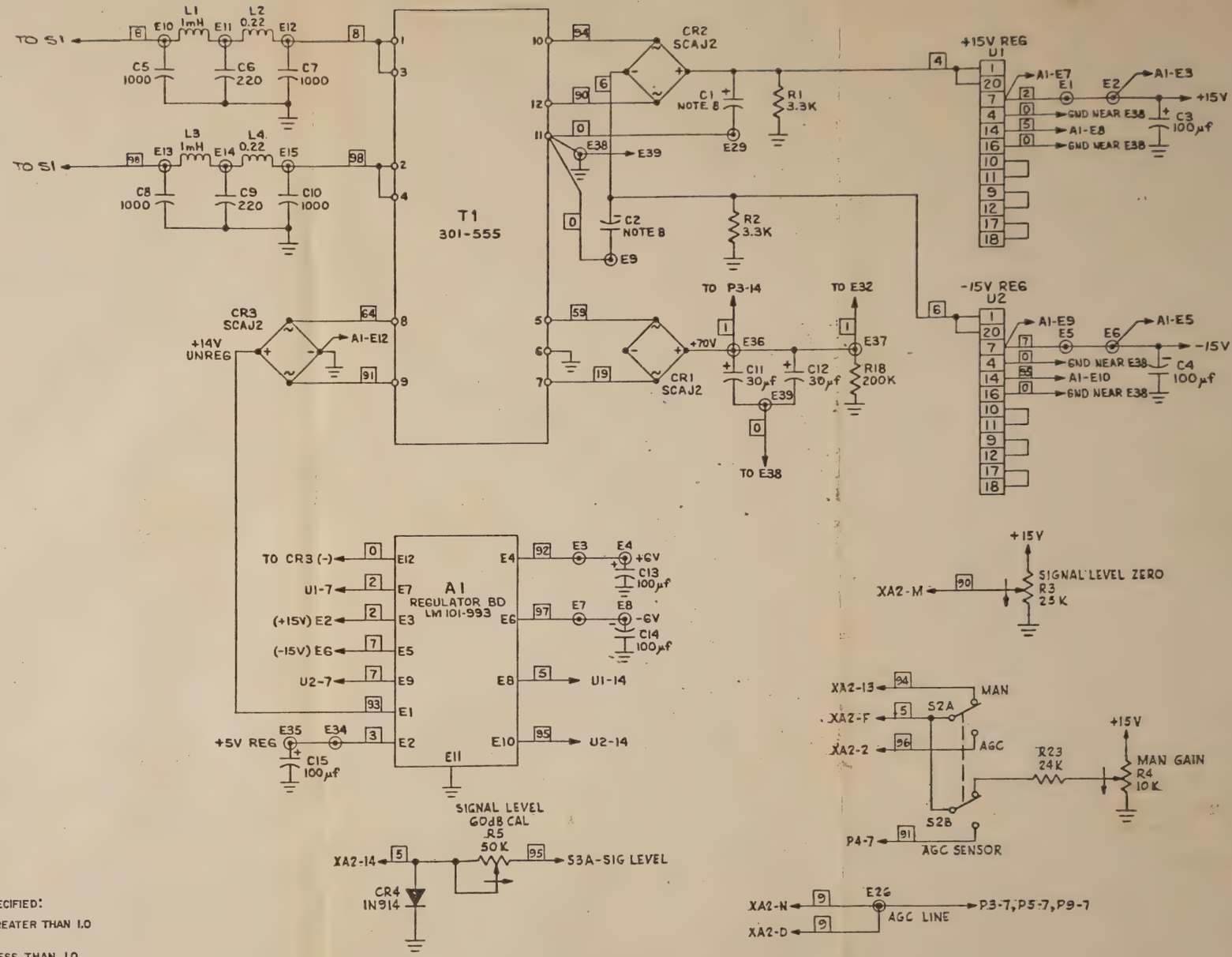


Figure 7-1. Main Chassis Wiring Diagram, Sheet 2 of 2



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. # DENOTES SELECTED VALUE.
6. —⊂⊃— FERRITE BEAD.
7. [7] FLAGS ARE COLOR CODE WIRES, PER MIL STD 681.
8. C1, C2, 5200 µf MAY BE SUBSTITUTED WITH 2200 µf CAPACITOR.

Figure 7-2. A1, Power Supply, Schematic Diagram

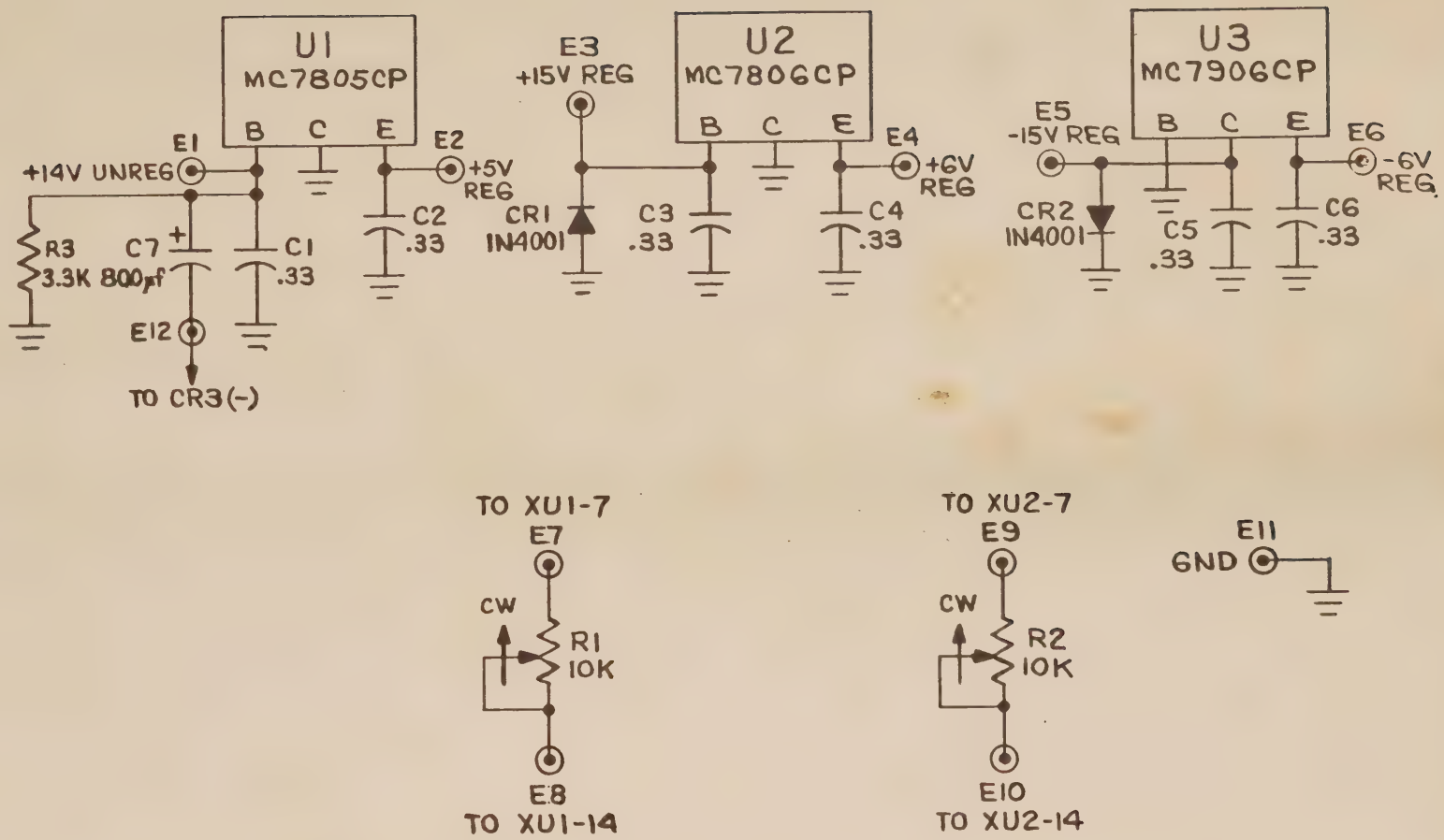


Figure 7-3. A1A1, Regulator Board, Schematic Diagram

Instruction Booklet

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103-051 RF TUNER

September 1976

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EQUIPMENT MODIFICATION

Modifications have been made to the tuner circuitry to improve its performance.

Gain Control Amplifier, A7

To improve gain control and stability, the following circuit changes were made:

L3 part number is changed from 203-086 to 203-475.
R3 and R5, values listed are selectable values.
C15 is not used.

The following have been added:
R14, 100Ω (selectable) resistor, between pin 2 of U2 and ground.
R15, 100Ω (selectable) resistor, between pin 4 of U3 and ground.
R16, 30Ω (selectable) resistor, in place of C15.
R17, 100Ω (selectable) resistor, between pin 2 of U4 and ground.

Remote Decoder, A15

To improve the VCO stability, the following changes were made to the decoder board:

R44 is changed to 16.5K, RN55D1652F
R40 is changed to 18.7K, RN55D1872F
R47 is changed to 12.1K, RN55D1212F

Delete R48 and R49.

R18 (1K potentiometer) is replaced with a 5.11K resistor, RN55D5111F, connected between pin 3 of U18 and ground.
A 270Ω resistor, CB2715, is connected between E28 and E29.
A zener diode, 1N943A (11.8V) is connected between E28 and ground.

Low Frequency Multiplier, A14:

To improve the temperature stability of the VCO, C58 is changed from 11 pF to 4.7 pF.

In addition to the above circuit modifications, the following changes should be inserted into the manual prior to its use in servicing the tuner.

Figure 12 - illustrate CR5 as a zener diode.
Gain and Gain Reduction Measurement - Reference test equipment list, test equipment drawing, and step c (page 8). Change the 50 ohm termination to read 75 ohms.

103-051 RF TUNER

GENERAL

The 103-051 RF Tuner is designed for use in the Microdyne 1100 Series TV/Satellite Receiver. The tuner functions to select, amplify, and down convert the standard 12 channel and 24 channel satellite television signals. The satellite television signal is converted to supply a 70 MHz i-f signal for further processing by the receiver. Noise figures of less than 12 dB are obtained over the tuning range.

The tuner employs a voltage-tuned, four-pole preselector to provide non-mechanical local and remote tuning across the signal band. Tuning interface is TTL compatible, BCD coded. Tuning selection of any one of 24 channels may be accomplished locally using a front panel digit switch or remotely through the use of a compatible digital control device; see the parent receiver instruction manual for details. A two digit display provides an indication of the channel selected.

INSTALLATION

There are no definite installation procedures for the rf tuner as it can be installed in various parent units. Any special procedures required for the installation of the tuner will be provided in the parent unit instruction manual under Repair and Replacement.

THEORY OF OPERATION

The rf tuner accepts an rf signal within the 3720 MHz to 4180 MHz frequency range and processes this signal to provide a 70 MHz i-f signal to the receiver i-f amplifier circuitry.

The rf signal is applied through a preamplifier to a voltage-controlled preselector which selects the desired signal channel. The selected signal channel is applied to a mixer where it is combined with a local oscillator signal to generate the 70 MHz i-f signal. The i-f signal is amplified by a gain-controlled amplifier and made available for application to the receiver i-f amplifier circuits.

Channel selection may be made locally or remotely depending on the setting of the local/remote switch. In either case, the selection is made through BCD coded signals which are decoded to develop a dc control voltage whose level is proportional to the selected channel. This control voltage is processed by shaping circuits to generate the tuning voltage for the local oscillator and for the preselector.

A wiring-block diagram of the tuner is shown in figure 7.

CIRCUIT DESCRIPTIONS

Reference should be made to the schematic diagram of the various subassemblies during the following discussions.

Preamplifier A1, Preselector A2, Isolator A4, and Mixer A5

The preamplifier, figure 9, consists of four tuned rf amplifier stages. The tuned circuits preceding and following the amplifier stages are employed to establish the bandwidth of the amplifiers as well as provide the selectivity. The preamplifier sets the vswr present at rf input.

Frequency selection is accomplished through the ganged-tuned, four-pole cavity preselector A2. The output of the preselector is routed through isolator A4 to the mixer. The isolator compensates for the mismatch of the mixer. The balanced mixer A5 accepts the rf output of the preselector and the injection signal from the local oscillator circuit, and supplies a 70 MHz difference frequency to the gain-controlled amplifier A7.

Gain Controlled Amplifier A7

Reference figure 12. The 70 MHz i-f signal from the mixer is applied through J1 to U1, which functions as a noise figure amplifier. U2, U3, and U4 are wideband power amplifiers. Gain control of the amplifier is accomplished by the agc voltage applied through FL2/E2. The agc voltage is used to control a pin diode attenuator consisting of CR1 through CR4 and associated circuitry. The attenuation offered to the 70 MHz signal output of U2 by the pin diode attenuator is determined by the level of the agc voltage. The overall gain of the amplifier is approximately 39 dB.

Variable Frequency Oscillator (VFO)

The VFO is located in the LF multiplier module A14, see figure 15. The circuit is composed of modified Colpitts oscillator Q3 and amplifier Q5.

Frequency selection is accomplished by a -5.4V to -11.3V dc input applied at C17. This voltage is supplied via the dc control and shaping circuit A3 from the remote/local decoder assembly, A15. A3 (figure 10) shapes the tuning voltage to match the linearity curve of the voltage variable capacitance diode CR1. As the tuning voltage is varied so does the capacitance of CR1, this capacitance is inversely proportional to the voltage change. Since CR1 is part of the oscillator tank circuit, any change in the capacitance results in a change of the frequency. Inductor L1 and capacitor C14 are used to set the operating range of the oscillator between 118.4375 MHz and 132.8125 MHz. The output of the oscillator is routed through amplifier Q2 to the multiplier chain.

LO Multiplier Chain

The local oscillator multiplier chain consists of modules A8 through A14 and provides a multiplication factor of 32 to the oscillator signal.

Reference figure 15. The first multiplication takes place in the LF multiplier module A14. (Q1 is provided for test purposes. It functions as a buffer stage permitting the injection through J1 of a swept input for testing and aligning of the multiplier stages.) The vfo signal is applied through Q2, which functions as a buffer amplifier. The l-o signal is coupled to Q4, a power amplifier used to drive Q5, a frequency doubler. The output of Q5, ranging between 235.6250 MHz and 266.8750 MHz, is applied through driver Q6 to power amplifier Q7. The output of Q7 is then coupled to an X4 multiplier composed of step recovery diode CR2 and the filter assembly A12. These stages operate in conjunction to pass only the fourth harmonic of the 236.8750 to 265.6250 MHz signal in order to supply a 947.5 - 1062.5 MHz signal to the X4 multiplier A11.

Reference figure 14. The l-o signal from the LF multiplier A14 is applied to the X4 multiplier A11 through J2. The signal is coupled through driver Q1 to power amplifier Q2. The output of Q2 is coupled to an X4 multiplier consisting of step recovery diode CR1 and the filter assembly A9. A11CR1 and A9 function to pass only the fourth harmonic of the 947.5 - 1062.5 MHz signal resulting in a 3790 - 4250 MHz l-o injection signal being applied to the mixer.

Tuning Control Circuits

The tuning control circuits consist of the remote/local decoder A15, the dc control and shaping board A3, and the channel select switch S1.

Channel selection may be made locally by the channel select switch or remotely by the application of a compatible BCD coded signal. In the local mode, the channel select switch outputs a six line BCD signal which is applied to data selectors, U1 and U2, in the remote/local decoder; see figure 16. U2 is the tens decode data selector and U1 is the units decode data selector. In the remote mode, the BCD inputs are externally applied from a compatible control unit. As commanded by the local/remote switch, the data selectors select and route either the local or the remote BCD input to U6, a BCD-to-binary converter. The outputs of the data selectors are also applied to the channel select display A16 which displays the digital value of the BCD signal.

The BCD-to-binary converter U6 drives 4-line to 10-line decoders, U7 - U8. The outputs of U7 - U8 are routed through hex inverters U9 - U10 to FET switches U11 - U17. Selected precision resistors for each channel are connected between +15V (E28) and the input of amplifier U18 through these switches. The switches select the appropriate resistor combination for the selected channel as commanded by the decoded BCD channel select signal; for example, R31 - R2 for channel 1. The voltage applied to, and consequently the output voltage of, amplifier U18 is a dc voltage whose level is proportional to the selected channel. This voltage is applied to the dc control and shaping board.

The dc control board is shown in figure 10 and is composed of unity gain buffer U1 and operational amplifier U2 - Q2 through Q5. Input to the subassembly is supplied from the decoder and ranges between -4.070V to -11.364V dc.

The -4.070V to -11.364V dc tuning voltage is applied to E1 and is coupled through R3 and R6 to terminal E5 for further application to the vco in the LF multiplier module. Connected

to the junction of R3/R6 is a shaping circuit composed of potentiometers R7, R10, R15, and diode CR1. This circuit is adjusted to shape the control voltage to compensate for the non-linearity of the vco tuning diode.

The -5.4V to -11.3V output at E5 is routed to unity gain operational amplifier U1. The output of the operational amplifier is passed through a second shaping network composed of R5-R12-R27-R29-CR2-CR3 to ensure tracking between the vco and the preselector. From the shaping network, the level is coupled through gain adjustment R14 to operational amplifier U2-Q2 through Q5. The output voltage is made available at terminal E8 for further application to the rf preselector and ranges from approximately +5V to +58V. Maximum and minimum voltage levels vary according to the particular tuner requirements and are adjusted by R14. Feedback is maintained between the input and output of the operational amplifier to obtain the necessary stability and shape. Diodes CR7 and CR8 are field-effect devices which function as constant current sources for the associated elements of the amplifier.

MAINTENANCE

Troubleshooting and repair of the rf tuner should be attempted only by personnel who have prior experience on similar equipment and who have suitable test equipment on hand. Then, only those troubleshooting-alignment procedures given herein are recommended. If these procedures are insufficient to permit the location and repair of the malfunction, the tuner should be returned to the factory for repair.

The troubleshooting procedures given herein are those that can be safely conducted in the field. Complete replaceable parts list and schematic diagrams are provided for all the modules. However, the following should be considered before attempting any additional tests. The close proximity of the test points requires extreme caution when taking measurements as a slip of the test lead can produce a short, damaging associated components. The physical location and/or placement of the components, wiring, and cabling is critical at these frequencies. A number of the modules require removal from the main chassis to permit access to their circuitry and unless these are replaced with care, nonrepairable damage can occur. The removal of the modules also prevents "live" testing without an elaborate test setup. In certain circuits, a replacement of a component requires realignment of the stage due to the tolerances of the part.

CHANNEL CENTER FREQUENCY CHECK/CALIBRATION

The channel center frequency check and/or adjustment should be conducted every six months. These are in actuality the adjustment of the local oscillator frequency which ensures the tuner operates at the center frequency of the channel selected. If it is found that the monitored frequencies are within 50 kHz of designed LO frequency, calibration is not necessary; this ±50 kHz is within the manufacturer's operating specifications and the parent receiver will perform satisfactorily in the system. During the calibration check, it may be found that only one or two of the channels are out of the 50 kHz limit. In this case, only these channels need be calibrated. However, if it is desired, all channels can be calibrated to the set center frequency.

The channel frequency adjustments must be made under operating conditions. The receiver should be in a temperature environment equivalent to that when employed in the receiving system. If it is not possible to conduct this check with the receiver in the equipment rack under operating conditions, power must be applied to the receiver at least three hours prior to the check/calibration. It is also recommended, that power be applied to the frequency counter one hour prior to the test. Due to the drift characteristics in cycles of the local oscillator, the frequency check should be made at several hour intervals before making any adjustments. The first measurement can be recorded and the second measurement compared to the first to obtain a mean reading.

The calibration/test requires the use of the following test equipment:

Digital Voltmeter	Fluke 8100A
Frequency Counter	HP5246L w/5254B Converter

a. Remove the bottom cover from the receiver to permit access to the tuner circuitry. Locate the remote/local decoder board. Note that the test points and adjustable components on this board (as on all the modules) are identified.

b. Select Channel 1. Allow a one-minute temperature stabilizing period. Using a digital voltmeter, measure the voltage at E30 on the remote/local decoder board. The voltage level at this point should be -4.070 volts. If necessary, adjust R2 on the decoder board to obtain the -4.070 volts.

c. Connect the frequency counter to the LO MONITOR output on the rear panel of the receiver. Note the counter reading. If necessary, carefully adjust L1 on the low frequency multiplier A14 for a counter reading of 236.875 MHz, ±10 kHz.

d. Switch to Channel 24. Allow a one-minute temperature stabilizing period and measure the voltage at E30, the voltage level should be -11.364 volts. If the voltage is not -11.364 volts, adjust R28 for the correct voltage.

e. Note the reading on the counter. It should be 265.625 MHz, ±10 kHz. If it is necessary to decrease the tuning range, adjust C14 on the low frequency multiplier A14 clockwise (increasing its capacitance) and then adjust L1 on the low frequency multiplier for a 265.625 MHz, ±10 kHz, reading on the counter.

f. Reselect Channel 1 and allow the one-minute stabilizing period. The voltage at E30 should be -4.070 volts and the counter should indicate 236.875 MHz, ±10 kHz. If necessary, readjust C14 to correct the tuning range and L1 to set the frequency.

g. Repeat steps d through f until the correct readings are obtained.

h. The channel frequency adjustments can now be made. Each channel has its own frequency adjust control and is located on the decoder board. This control is adjusted for the correct LO frequency at the LO MONITOR output (as indicated on the frequency counter). Switch to each channel in turn, wait one minute for the channel to temperature stabilize, and adjust the appropriate control on the decoder board for the correct frequency indication on the counter. The counter readings can be ±5 kHz of those listed. The control identification and appropriate LO frequency for each channel is given below:

Channel No. (12 Channel Tuner)	Channel No. (24 Channel Tuner)	Decoder Board Control No.	Counter Frequency
1	1	R2	236.875 MHz
--	2	R4	238.125 MHz
2	3	R3	239.375 MHz
--	4	R7	240.625 MHz
3	5	R8	241.875 MHz
--	6	R6	243.125 MHz
4	7	R5	244.375 MHz
--	8	R9	245.625 MHz
5	9	R10	246.875 MHz
--	10	R12	248.125 MHz
6	11	R11	249.375 MHz
--	12	R15	250.625 MHz
7	13	R16	251.875 MHz
--	14	R14	253.125 MHz
8	15	R13	254.375 MHz
--	16	R20	255.625 MHz
9	17	R19	256.875 MHz
--	18	R21	258.125 MHz
10	19	R22	259.375 MHz
--	20	R26	260.625 MHz
11	21	R25	261.875 MHz
--	22	R23	263.125 MHz
12	23	R24	264.375 MHz
--	24	R28	265.625 MHz

TROUBLESHOOTING

Gain and Gain Reduction Measurement

This measurement may be used as an overall check of the tuner. If the correct gain measurement is obtained, it can be assumed that the tuner is operating satisfactorily, and if a malfunction exists, it is located elsewhere in the receiver or system. If the correct gain-measurements are not obtained, a malfunction exists in the tuner. In this case, the factory may be consulted for maintenance support or further checks of the tuner may be made if suitable test equipment is available; see the LO multiplier chain and the low frequency multiplier A14 checks given herein.

The following test equipment, or equivalent, is required to conduct the gain measurements:

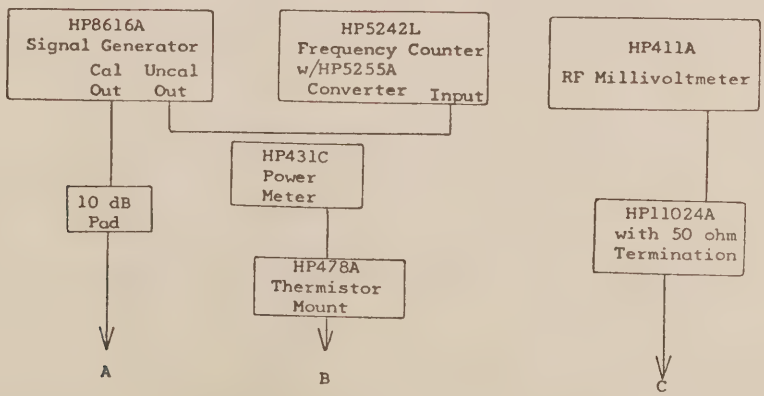
Signal Generator	HP8616A
Frequency Counter	HP5242L w/HP5255A plug-in
10 dB Pad	Weinschel 1
Power Meter	HP431C
Thermistor Mount	HP478A
RF Multivoltmeter	HP411A
50 ohm Termination	HP11024A
DC Voltmeter	Fluke 8100A

In addition to the listed test equipment, the following cable and adapters are required. Reference the test equipment setup given under step a below.

The signal generator should be connected to the 10 dB pad using an RG-9/U cable. The cable should be of sufficient length to permit the 10 dB pad to be physically connected directly on the receiver. The RG-9/U cable should have type RG-21 D/U connectors on each end.

A Phelps Dodge 700029 connector is recommended to permit connecting the HP411A to the IF cable in the receiver.

a. Remove the covers from the receiver. Connect the test equipment as shown below. The frequency counter and the power meter with thermistor mount are used to calibrate the signal generator.



b. Refer to the test equipment setup drawing. Connect A to B. Set the HP8616's output frequency to 3720 MHz and its rf output attenuator to -10 dB. Adjust the HP8616A's ALC (Cal Output) to produce a -20 dBm reading on the HP421C power meter. Disconnect A from B.

c. Connect A (Signal Generator/10 dB Pad) to the RF input connector J1 on the receiver. In the receiver, disconnect the cable connected to J1 on the IF Amplifier/Equalizer module A5. Connect the Phelps Dodge connector to the cable. Connect the HP411/50 ohm termination (point C of the equipment setup) to the Phelps Dodge connector.

d. Apply power to the receiver. Set the receiver for manual gain control. Using a DC Voltmeter connected to E26, AGC test point, adjust the gain control for -1V indication on the voltmeter. Remove the voltmeter.

e. Select Channel 1 and adjust the RF output of the HP8616A to produce a -10 dBm reading on the HP411A RF millivoltmeter. Note the setting of the HP8616A's RF attenuator. With this equipment setup, the transfer gain of the tuner is equal to the setting of the RF attenuator. The transfer gain should be 40(±4) dB.

f. Select Channel 2 and set the HP8616A's RF output frequency to 3740 MHz and adjust the 8616A's RF output to produce a -10 dBm reading on the HP411A. Note the transfer gain (40(±4) dB).

g. Repeat step f for each of the remaining channels. In all cases, the transfer gain should be 40(±4) dB.

h. Select Channel 12 and adjust the RF output of the HP8616A to produce a -10 dBm reading on the HP411A. Note the HP8616A's attenuator reading (40(±4) dB).

i. Adjust the receiver AGC to -5 volts (E26).

j. Adjust the HP8616A's RF output to produce a -10 dBm reading on the HP411A. Note the gain reduction measurement; it should be 26 dB minimum.

k. Remove power from the receiver and disconnect the test equipment. Remove the Phelps Dodge connector from the IF cable and reconnect the cable to J1 on the IF Amplifier/Equalizer module. Return power to the receiver and reset the AGC voltage; see the parent unit instruction manual, if necessary, for the AGC adjustment procedures.

Multiplier Chain

The following tests may be conducted to check the local oscillator multiplier chain. The multiplier chain consists of the low frequency multiplier A14, LO filter A12, X4 multiplier A11, LO filter A9, and pads A8, A10 and A13. If this test indicates a fault in the multiplier chain, check the low frequency multiplier (recommended procedures are given herein).

The pads and the filters are passive devices and should not develop a fault. Due to the design of the X4 multiplier, troubleshooting of this module is not recommended. The factory should be consulted if a malfunction appears to exist in this module.

The testing of the multiplier chain requires the use of the following test equipment:

Sweep Generator	Wavetek 2001
Oscilloscope	HP1200A
Signal Generator	HP608A
Frequency Counter	HP5246L w/HP5254B Converter

In addition to the test equipment, the following cables/adapters are recommended:

Low Frequency Multiplier Test Cable

RG-174/U cable, 3 feet, with a UG-1465/U connector on one end and a Bendix 30517-10 connector on the other end. This cable may be fabricated or purchased from Microdyne Corporation, part number 203-391-50.

Mixer Bias Test Point Adapter

An alligator clip with 0.01 uF capacitor soldered to it, and with an insulated sleeve.

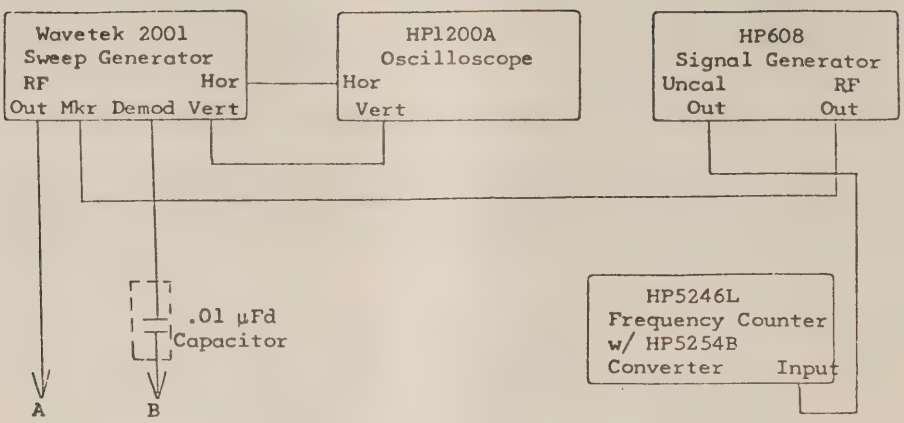
a. Remove top and bottom covers of the receiver to permit access to the tuner circuitry. Remove Q3 from the low frequency multiplier module. This deactivates the local oscillator.

b. Connect the test equipment as shown on the following page. Then, connect point A of the test setup (Sweep Generator RF Out) to J1 on the low frequency multiplier using the test cable. Connect point B (Sweep Generator Demod) of the test setup through the adapter to E2 on the mixer (bias test point).

c. Set the RF output level of the Wavetek to 0 dBm and its sweep range greater than 117.8125 - 133.4375 MHz.

d. Set the vertical input of the HP1200A oscilloscope to 100 millitvolts per division. Set the output frequency of the HP608 to mark 118.4375 - 132.8125 MHz.

e. Apply power to the receiver; allow a five-minute warmup period.



f. Adjust C2, C4, C6, C15, C11 and C13 (located on the X4 multiplier) slightly to produce a flat response (±0.75 dB ripple) as observed on the oscilloscope.

g. The sweep response should be greater than 300 millivolts from 3790 to 4250 MHz. If this response is obtained, the multiplier chain is functionally satisfactory.

h. Remove power from the receiver, disconnect the test equipment and reinstall Q3 in the low frequency multiplier module.

Incorrect/Missing Channel Frequency

These tests are designed to localize the fault when the tuner fails to operate on one or more of the channels. The tests are designed to isolate the fault to either the decoder board, the control and shaping board, or the low frequency multiplier.

This test requires the use of a

Digital Voltmeter Fluke 8100A

a. Remove the covers from the receiver to permit access to the tuner circuitry. Locate the remote/local decoder board, accessible from the bottom of the reciever.

b. Apply power to the receiver and select channel 1. Allow a five-minute warmup period. Using the digital voltmeter, measure the voltage at E30 on the decoder board; it should be -4.070 volts. Adjust R2 on the decoder board, if necessary, to obtain this voltage.

c. Select channel 24. Allow a one-minute warmup stabilizing period and measure the voltage at E30; it should be -11.364 volts. Adjust R28 on the decoder board, if necessary, to obtain this voltage.

d. Switch through each channel in turn, allowing the one-minute stabilizing period, and measure the voltages at E30 and compare them with those listed below. The voltage levels at E30 are satisfactory if they are within ±0.100V of those listed.

Channel 1	-4.070	Channel 7	-5.937	Channel 13	-7.819	Channel 19	- 9.852
Channel 2	-4.493	Channel 8	-6.238	Channel 14	-8.151	Channel 20	-10.146
Channel 3	-4.790	Channel 9	-6.544	Channel 15	-8.488	Channel 21	-10.438
Channel 4	-5.068	Channel 10	-6.855	Channel 16	-8.829	Channel 22	-10.739
Channel 5	-5.352	Channel 11	-7.171	Channel 17	-9.174	Channel 23	-11.045
Channel 6	-5.642	Channel 12	-7.493	Channel 18	-9.521	Channel 24	-11.364

If the above voltages (±100 mV) are obtained, the decoder board is functioning properly. In this case, proceed to the next step. If the voltage is absent or out-of-range for a channel, a malfunction exists in the decoder board.

e. Locate the DC control and shaping board; accessible from the top of the receiver. Using the digital voltmeter, measure the voltage at E5 as the tuner is switched through each of the channels. Allow the one-minute stabilizing period before taking the measurements. Compare the measured voltages with those listed below. The voltage readings at E5 are satisfactory if they are within ±0.150V of those listed.

Channel 1	-5.499	Channel 7	-6.776	Channel 13	-8.220	Channel 19	- 9.817
Channel 2	-5.695	Channel 8	-7.007	Channel 14	-8.476	Channel 20	-10.097
Channel 3	-5.898	Channel 9	-7.242	Channel 15	-8.736	Channel 21	-10.388
Channel 4	-6.110	Channel 10	-7.480	Channel 16	-9.000	Channel 22	-10.688
Channel 5	-6.328	Channel 11	-7.723	Channel 17	-9.268	Channel 23	-10.992
Channel 6	-6.550	Channel 12	-7.970	Channel 18	-9.542	Channel 24	-11.311

If the correct voltages are not obtained at E5 on the DC control board and the decoder voltages (step d) are satisfactory, then a fault exists in the DC control and shaping board. It is strongly recommended that the tuner be returned to the factory for repair of this board. The DC control and shaping board must be removed to allow testing and the circuitry on the board is delicately adjusted. Unless extreme care is taken in removal of the board, nonrepairable damage can result - also, the adjustments on the board are critical and must be made under "live" conditions which require an elaborate test setup.

If the correct voltages are obtained on the DC control board and on the decoder board, the fault is assumed to be in the low frequency multiplier. A check of the module may be made, if desired, using the procedure given herein.

Low Frequency Multiplier

The procedures provided herein permit an operational check of the low frequency multiplier and provide troubleshooting data should the operational check detect a malfunction.

Operational Check - Low Frequency Multiplier

This test provides a check of the low frequency multiplier as well as pad A13 and LO filter A12. The test also checks the cabling between these modules and the X4 multiplier A11.

Refer to the Multiplier Chain Troubleshooting procedures for the required test equipment and for the test equipment setup. The adapter (alligator clip with capacitor(is not used. The following additional items are required:

Power Meter	HP478
RF Detector	HP423A
Adapter, PDM type N Jack	Phelps-Dodge 721

Consult the RF detector to the Demod connector on the sweep generator. Then connect the adapter to the RF detector.

a. Remove the top and bottom covers from the receiver to permit access to the tuner circuitry. Remove Q3 from the low frequency multiplier module.

b. Disconnect the cable connected between LO filter A12 and X4 multiplier A11 at J1 of A11. Carefully position the cable so as to permit connecting the Phelps-Dodge adapter (attached to the RF detector).

c. Connect the RF Out of the sweep generator through the low frequency multiplier test cable, to J1 on the low frequency multiplier module.

d. Set the RF output of the Wavetek generator to 0 dBm and its sweep range greater than 117.8125 - 133.4375 MHz. Set the output frequency of the HP608 to mark 118.4375-132.8125 MHz.

e. Set the vertical input of the HP1200A oscilloscope to 100 millivolts per division.

f. Apply power to the receiver and allow a five-minute warmup period.

g. Note the response on the oscilloscope. The response should be centered between 947.5 MHz and 1062.5 MHz. Disconnect the HP423 detector from the cable and connect the HP478 power meter to the cable. The power output at this point should be a minimum of 0 dBm.

h. Remove power from the receiver; disconnect the test equipment and reinstall Q3.

If the results given in step g are not obtained, troubleshooting of the low frequency multiplier may be desirable. First check the cables connected between the modules for the possible cause of the fault.

Troubleshooting - Low Frequency Multiplier

Troubleshooting of the module should be attempted only by experienced personnel and then caution must be taken during both the physical and electrical aspects of the testing.

To gain access to the low frequency multiplier circuitry, the bottom cover on the module must be removed.

To aid in troubleshooting the low frequency multiplier, a dc voltage chart is given below. These voltages are obtained with the voltage at:

E3, E4 = +15.00V
C57 = -15.00V
C17 = -5.43V

which should occur when channel 1 is selected.

With Q3 removed:

	C	B	E
Q1	- 5.38	-8.07	-8.86
Q2	- 3.28	-7.76	-8.53
Q3	Removed		
Q4	+14.95	+7.09	+6.35
Q5	+14.93	0.00	0.00
Q6	+14.88	+2.76	+2.16
Q7	+14.88	+2.34	+1.67

With Q3 installed:

Q3	- 3.15	-8.47	-7.77

These are typical voltage readings and can vary between units.

Due to the complications involved, it is suggested that no attempt be made to replace the transistors installed with the heat sinks. If a component is found defective, the stage associated with the component may need to be realigned. Recommended alignment procedures for the complete module is given herein.

Realignment - Low Frequency Multiplier

Realignment of the low frequency multiplier may be necessary if repair requires the replacement of a component. Alignment should be limited to the stage associated with the replaced component. The procedures provided below are general alignment for the multiplier, and when completed, calibration will be necessary; see the instructions under Channel Center Frequency Check/Calibration on page 4.

The test equipment requirements are:

Sweep Generator	Wavetek 2001
Oscilloscope	HP1200A
Signal Generator	HP608
Frequency Counter	HP5246L w/HP5254 Converter
Detector	HP423A
Detector	Aertech D-10
Test Cables (2 required)	Low Frequency Multiplier, see description given under Multiplier Chain Troubleshooting
Adapter, PDM Type N Jack	Phelps-Dodge 721
Power Meter	HP478

a. Remove the top cover from the receiver to permit access to the low frequency multiplier adjustments.

b. Connect the test equipment as used in troubleshooting of the multiplier chain, except the test point adapter (0.01 capacitor) is not used.

c. Remove Q3 from the low frequency multiplier module.

d. Disconnect the cable connected to J1 of the X4 multiplier module.

e. Apply power to the receiver and allow a five-minute warmup period.

f. Set the Wavetek's sweep range greater than 117.81 - 133.44 MHz and its output level to 0 dBm.

g. Using the test cable, connect the RF output of the Wavetek to J1 on the low frequency multiplier.

h. Using the second test cable, connect the D-10 detector between the demod input of the Wavetek and TP1 on the low frequency multiplier.

i. Set the HP1202's controls for a convenient response amplitude.

j. Set the HP608's output frequency to mark 117.8125 - 133.4375 MHz.

k. Adjust L1, L2, C26 and C29 on the low frequency multiplier for a maximum response amplitude centered between 235.625 and 266.875 MHz.

l. Disconnect the D-10 detector input from TP1 and reconnect it to J3 on the multiplier. Adjust C36 and C39 on the low frequency multiplier for a maximum response amplitude centered between 235.625 and 266.875 MHz.

m. Disconnect the D-10 detector from J3 and from the demod input on the Wavetek sweep generator.

n. Connect the output of the HP423A detector to the demod input on the Wavetek generator and input of the HP423A detector to the cable that normally connects to the X4 multiplier. Use the Phelps Dodge adapter.

o. Adjust C45, C48, C52 and C53 on the low frequency multiplier for a maximum amplitude response centered between 942.5 and 1067.8 MHz (117.8125 - 133.4375 MHz) on the HP608 marker generator and the Wavetek 2001 sweep generator.

p. Disconnect the Wavetek from J1 of the low frequency multiplier.

q. Remove power from the receiver and reinstall Q3 in the low frequency multiplier. Return power to the receiver.

r. Connect the frequency counter to the LO Monitor output on the rear panel of the receiver. Select Channel 1.

s. Adjust A14L1's adjustment screw height to 0.85 inch above the chassis, ONLY IF THIS COMPONENT WAS REPLACED.

t. Adjust C14 on the low frequency multiplier for counter reading of 236.875 MHz.

u. Select Channel 24; the counter should indicate 265.625 MHz.

v. To decrease the tuning range, adjust C14 on the low frequency multiplier clockwise and then adjust L2 for a counter reading of 265.625 MHz.

w. Select Channel 1; the counter should indicate 236.875 MHz. If necessary, adjust C14 and L1 for the correct frequency.

x. Repeat steps u and w until the correct readings are obtained.

y. Disconnect the HP423 detector from the cable and connect the HP478 power meter in its place.

z. Select Channel 1, 6, 12, 18, and 24 in turn and observe the power output (as recorded on the power meter). It should be +2 dBm, ±2 dB.*

This completes the alignment and test of the low frequency multiplier. Disconnect the test equipment and reconnect the cable to J1 on the X4 multiplier. Conduct the channel center frequency calibration as given on page 4.

*A replacement of a transistor in the low frequency multiplier may change the overall gain, preventing the obtaining of the +2 dBm (±2 dB) output power. In this case, A13 pad must be replaced with the replacement selected to compensate for the increased or decreased gain.

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer, and manufacturer's part number for each electrical component used in the RF Tuner. Include all information when ordering spare or replaceable components.

Main Chassis

Reference Designation	Description
A1	Preamplifier, Microdyne 103-024; see paragraph below for breakdown listing
A2	Preselector, Microdyne 101-972; nonrepairable
A3	DC Control and Shaping Board, Microdyne 103-067; see paragraph below for breakdown listing
A4	Isolator, Aertech AMF-3742; nonrepairable
A5	Mixer, 3.6-4.2 GHz, Anaren 7J0340; nonrepairable
A6	Not Assigned
A7	70 MHz Gain Controlled Amplifier, Microdyne 101-898; see paragraph below for breakdown listing
A8	3 dB Pad, Midwest Microwave 444-3; nonrepairable
A9	Tubular LO Filter, Microdyne 101-889; nonrepairable
A10	6 dB Pad, Allen Industries 50SPA6; nonrepairable, selectable
A11	X4 Multiplier, Microdyne 101-912; see paragraph below for breakdown listing
A12	Tubular LO Filter, Microdyne 101-887; nonrepairable
A13	6 dB Pad, Allen Industries 50SPA6; nonrepairable, selectable
A14	Low Frequency Multiplier, Microdyne 101-909; see paragraph below for breakdown listing
A15	Remote-Local Decoder, Microdyne 103-094; see paragraph below for breakdown listing
A16	Channel Select Display, Microdyne 103-017; see paragraph below for breakdown listing
CP1	Connector, Phelps Dodge 716-001
CP2	Connector, Phelps Dodge 716-001
E1	Termination, standoff, teflon, Sealectro ST-SM-1
E2	Termination, feedthru, teflon, Sealectro FT-SM-1
J1	Connector, AMP 205208-1
P1	Connector, p/o W1, Phelps Dodge 522-004
P2	Connector, p/o W1, Phelps Dodge 522-004
P3	Not Assigned

Replaceable Parts List - Main Chassis, continued

Reference Designation	Description
P4	Connector, p/o W2, Phelps Dodge 522-004
P5	Connector, p/o W2, Phelps Dodge 522-004
P6	Connector, p/o W3, Phelps Dodge 546-001
P7	Connector, p/o W3, Phelps Dodge 546-001
P8	Not Assigned
P9	Not Assigned
P10	Connector, p/o W5, Phelps Dodge 522-004
P11	Connector, p/o W5, Phelps Dodge 522-004
P12	Connector, p/o W6, Phelps Dodge 522-004
P13	Connector, p/o W6, Phelps Dodge 524-001
P14	Connector, p/o W7, Phelps Dodge 524-001
P15	Connector, p/o W7, Phelps Dodge 522-004
R1	Resistor, fixed composition, 2.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2725
S1	Switch, CDI MPB2001015
S2	Switch, with dress nut and red cap, C&K 7101
W1	Cable Assembly, Microdyne 203-342
W2	Cable Assembly, Microdyne 203-343
W3	Cable Assembly, Microdyne 203-159-9
W4	Not Assigned
W5	Cable Assembly, Microdyne 203-344
W6	Cable Assembly, Microdyne 203-345
W7	Cable Assembly, Microdyne 203-346

A1, Preamplifier

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 103-023
C1	Capacitor, filtercon, Erie 1250-003
J1	Connector, Phelps Dodge 616-001
J2	Connector, Phelps Dodge 616-001

Replaceable Parts List, continued

A1A1, Printed Circuit Board Assembly

Reference Designation	Description
C1	Capacitor, variable 0.1 - 1.3 pF, Johanson 7265
C2	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C3	Not Assigned
C4	Not Assigned
C5	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C6	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C7	Capacitor, 0.01 μF, Mono-Die CF14-04
C8	Capacitor, 0.01 μF, Mono-Die CF14-04
C9	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C10	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C11	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C12	Not Assigned
C13	Not Assigned
C14	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP, selectable value
C15	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C16	Capacitor, 0.01 μF, Mono-Die CF14-04
C17	Capacitor, 0.01 μF, Mono-Die CF14-04
C18	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C19	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C20	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C21	Not Assigned
C22	Not Assigned
C23	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP, selectable value
C24	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C25	Capacitor, 0.01 μF, Mono-Die CF14-04
C26	Capacitor, 0.01 μF, Mono-Die CF14-04
C27	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C28	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C29	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C30	Not Assigned
C31	Not Assigned
C32	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP, selectable value
C33	Capacitor, chip, 47 pF ±10%, Johanson 50R15N470KP
C34	Capacitor, 0.01 μF, Mono-Die CF14-04
C35	Capacitor, 0.01 μF, Mono-Die CF14-04
C36	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
C37	Capacitor, variable, 0.1 - 1.3 pF, Johanson 7265
L1 thru L4	Inductor, 35 μH, Piconics S350K

Replaceable Parts List - A1A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
Q1	Transistor, npn, Hewlett Packard HP35866EOPT001
Q2 thru Q4	Transistor, npn, Hewlett Packard HP35866E
R1	Resistor, fixed composition, 3.3KΩ ±5%, 1/8w, Allen Bradley BB3325
R2	Resistor, fixed composition, 1KΩ ±5%, 1/8w, Allen Bradley BB1025
R3	Resistor, fixed composition, 300Ω ±5%, 1/8w, Allen Bradley BB3015
R4	Resistor, fixed composition, 3.3KΩ ±5%, 1/8w, Allen Bradley BB3325
R5	Resistor, fixed composition, 1KΩ ±5%, 1/8w, Allen Bradley BB1025
R6	Resistor, fixed composition, 200Ω ±5%, 1/8w, Allen Bradley BB2015
R7	Resistor, fixed composition, 3.3KΩ ±5%, 1/8w, Allen Bradley BB3325
R8	Resistor, fixed composition, 1KΩ ±5%, 1/8w, Allen Bradley BB1025
R9	Resistor, fixed composition, 200Ω ±5%, 1/8w, Allen Bradley BB2015
R10	Resistor, fixed composition, 3.3KΩ ±5%, 1/8w, Allen Bradley BB3325
R11	Resistor, fixed composition, 1KΩ ±5%, 1/8w, Allen Bradley BB1025
R12	Resistor, fixed composition, 200Ω ±5%, 1/8w, Allen Bradley BB2015

A3, DC Control & Shaping Board

Reference Designation	Description
C1	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C2	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
C3	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
C4	Capacitor, tantalum, 47 μF ±20%, 20V, Kemet T362C476M020AS
C5	Capacitor, tantalum, 47 μF ±20%, 20V, Kemet T362C476M020AS
C6	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M, nominal value
C7	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
C8	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M

Replaceable Parts List - A3, DC Control & Shaping Board, continued

Reference Designation	Description
CR1 thru CR6	Diode, 1N914
CR7*	Diode, Motorola 1N5285
CR8*	Diode, Motorola 1N5285
E1 thru E8	Termination, pin, AMP 61067-1
Q1	Not Assigned
Q2 thru Q4	Transistor, Motorola 2N4410
Q5	Transistor, Sprague 2N4384
R1	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R2	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R3	Resistor, fixed composition, 47KΩ ±5%, ¼w, Allen Bradley CB4735
R4	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R5	Potentiometer, 10KΩ, Beckman 66XR10K
R6	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R7	Potentiometer, 200KΩ, Beckman 66XR200K
R8	Resistor, fixed composition, 200KΩ ±5%, ¼w, Allen Bradley CB2045
R9	Resistor, fixed composition, 1.8KΩ ±5%, ¼w, Allen Bradley CB1825
R10	Potentiometer, 2KΩ, Beckman 66XR2K
R11	Resistor, fixed composition, 5.6KΩ ±5%, ¼w, Allen Bradley CB5625
R12	Potentiometer, 10KΩ, Beckman 66XR10K
R13	Resistor, fixed composition, 47KΩ ±5%, ¼w, Allen Bradley CB4735
R14	Potentiometer, 200KΩ, Beckman 66XR200K
R15	Potentiometer, 200KΩ, Beckman 66XR200K
R16	Resistor, fixed composition, 200KΩ ±5%, ¼w, Allen Bradley CB2045
R17	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R18	Resistor, fixed composition, 47KΩ ±5%, ¼w, Allen Bradley CB4735
R19	Potentiometer, 200KΩ, Beckman 66XR200K
R20	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R21	Potentiometer, 2KΩ, Beckman 66XR2K

* May be replaced by 1N5285 through 1N5290

Replaceable Parts List - A3, DC Control & Shaping Board, continued

Reference Designation	Description
R22	Resistor, fixed composition, 91KΩ ±5%, ¼w, Allen Bradley CB9135
R23	Resistor, fixed composition, 1.3MΩ ±5%, ¼w, Allen Bradley CB1355
R24	Resistor, fixed composition, 130KΩ ±5%, ¼w, Allen Bradley CB1345
R25	Resistor, fixed composition, 620Ω ±5%, ¼w, Allen Bradley CB6215, nom. value
R26	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R27	Potentiometer, 50KΩ, Beckman 66XR50K
R28	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R29	Potentiometer, 50KΩ, Beckman 66XR50K
R30	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R31	Resistor, fixed composition, 100KΩ ±5%, ¼w, Allen Bradley CB1045
U1	Operational Amplifier, Fairchild μA741
U2	Operational Amplifier, Fairchild μA741

A7, 70 MHz Gain Controlled Amplifier

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 101-899
FL1 thru FL4	Filtercon, 1250-003

A7A1, Printed Circuit Board Assembly

Reference Designation	Description
C1	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C2	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J
C3	Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8131-100-COG-470J
C4	Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8131-100-COG-470J
C5	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J
C6	Capacitor, ceramic, 680 pF ±20%, 100V, Erie 8121-100-COG-681M
C7	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C8	Capacitor, ceramic, 680 pF ±20%, 100V, Erie 8121-100-COG-681M
C9	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C10	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C11	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M

Replaceable Parts List - A7A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
C12	Capacitor, ceramic, 510 pF ±5%, 100V, Erie 8121-100-COG-511J
C13	Capacitor, ceramic, 510 pF ±5%, 100V, Erie 8121-100-COG-511J
C14	Capacitor, ceramic, 510 pF ±5%, 100V, Erie 8121-100-COG-511J
C15	Capacitor, ceramic, 620 pF ±20%, 100V, Erie 8121-100-COG-621M
C16	Capacitor, ceramic, 620 pF ±20%, 100V, Erie 8121-100-COG-621M
C17	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
CR1 thru CR4	Diode, silicon, Microwave Associates MA47110
CR5	Diode, silicon, Motorola 1N4731A
J1	Connector, modified, Microdyne 202-997
J2	Connector, modified, Microdyne 202-997
L1	Inductor, Microdyne 203-086
L2	Inductor, Microdyne 203-087
L3	Inductor, Microdyne 203-086
R1	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R2	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R3	Resistor, fixed composition, 240Ω ±5%, ¼w, Allen Bradley CB2415
R4	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R5	Resistor, fixed composition, 430Ω ±5%, ¼w, Allen Bradley CB4315
R6	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R7	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R8	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R9	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R10	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R11	Resistor, fixed composition, 360Ω ±5%, 1/2w, Allen Bradley EB3615
R12	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R13	Resistor, fixed composition, 24Ω ±5%, ¼w, Allen Bradley CB2405
U1	Amplifier, Anzac AM117
U2	Amplifier, Avanten GPD401
U3	Amplifier, Avanten GPD402
U4	Amplifier, Avanten GPD402

Replaceable Parts List, continued

A11, X4 Multiplier Module

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 101-911
FL1	Filtercon, Erie 1250-003
Z1	Ferrite Bead, Fair Rite 9820-1
Z2	Ferrite Bead, Fair Rite 9820-1

A11A1, Printed Circuit Board Assembly

Reference Designation	Description
C1	Capacitor, ceramic, chip, 4.7 pF ±0.25 pF, Mono Die 50R15N4R7CT
C2	Capacitor, variable, 0.6 - 4.5 pF, Johanson 7275
C3	Capacitor, ceramic, chip, 0.01 μF ±20%, Mono Die CF1404
C4	Capacitor, variable, 0.6 - 4.5 pF, Johanson 7275
C5	Not Assigned
C6	Capacitor, variable, 0.6 - 4.5 pF, Johanson 7275
C7	Capacitor, ceramic, chip, 2.2 pF ±0.25 pF, Mono Die 50R15N2R2CT
C8	Capacitor, ceramic, chip, 0.01 μF ±20%, Mono Die CF1404
C9	Capacitor, ceramic, chip, 0.01 μF ±20%, Mono Die CF1404
C10	Capacitor, ceramic, chip, 2.2 pF ±0.25 pF, Mono Die 50R15N2R2CT
C11	Capacitor, variable, 0.6 - 4.5 pF, Johanson 7275
C12	Capacitor, ceramic, chip, 10 pF ±0.25 pF, Mono Die 50R15N100CT
C13	Capacitor, variable, 0.6 - 4.5 pF, Johanson 7275
C14	Capacitor, ceramic, chip, 10 pF ±0.25 pF, Mono Die 50R15N100CT
C15	Capacitor, ceramic, chip, 0.6 - 4.5 pF, Johanson 7275
C16	Capacitor, ceramic, chip, 4.7 pF ±0.25 pF, Mono Die 50R15N4R7CT
CR1	Diode, step recovery, Hewlett Packard 5082-0830
J1	Connector, Microdyne 202-997
J2	Connector, Microdyne 202-997
L1	Inductor, integral part of printed circuit board
L2	Inductor, integral part of printed circuit board
L3	Inductor, integral part of printed circuit board
L4	Inductor, integral part of printed circuit board
L5	Inductor, integral part of printed circuit board

Replaceable Parts List - A11A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
L6	Inductor, integral part of printed circuit board
L7	Inductor, integral part of printed circuit board
Q1	Transistor, Hewlett Packard HP35821E
Q2	Transistor, Hewlett Packard HP35859E
R1	Resistor, fixed composition, 3KΩ ±5%, 1/8w, Allen Bradley BB3025
R2	Resistor, fixed composition, 1KΩ ±5%, 1/8w, Allen Bradley BB1025
R3	Resistor, fixed composition, 130Ω ±5%, ¼w, Allen Bradley CB1315
R4	Resistor, fixed composition, 820Ω ±5%, 1/8w, Allen Bradley BB8215
R5	Resistor, fixed composition, 1KΩ ±5%, 1/8w, Allen Bradley BB1025
R6	Resistor, fixed composition, 300Ω ±5%, 1/8w, Allen Bradley BB3015
R7	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905
R8	Resistor, fixed composition, 5.1KΩ ±5%, 1/8w, Allen Bradley BB5125

A14, Low Frequency Multiplier

Reference Designation	Description
C1	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C2	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C3	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C4	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8111-100-COG-150J, nom. value
C5	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8111-100-COG-150J, nom. value
C6	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C7	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C8	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C9	Capacitor, ceramic, 12 pF ±5%, 100V, Erie 8111-100-COG-120J
C10	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C11	Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8131-100-COG-470J
C12	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8111-100-COG-150J
C13	Capacitor, ceramic, 5.6 pF ±0.25 pF, 100V, Erie 8101-100-COG-569C
C14	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C15	Capacitor, 3 pF, Erie CC20UJ030C
C16	Capacitor, ceramic, 510 pF ±5%, 100V, Erie 8121-100-COG-511J
C17	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C18	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C19	Capacitor, ceramic, 12 pF ±5%, 100V, Erie 8111-100-COG-120J, nom. value

Replaceable Parts List - A14, Low Frequency Multiplier, continued

Reference Designation	Description
C20	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C21	Capacitor, ceramic, 3.6 pF ±0.25 pF, 100V, Erie 8101-100-COG-369C
C22	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J, nominal value
C23	Capacitor, ceramic, 3.6 pF ±0.25 pF, 100V, Erie 8101-100-COG-369C, nominal value
C24	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C25	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C26	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C27	Capacitor, ceramic, 5.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-519C, nominal value
C28	Capacitor, ceramic, 3.9 pF ±0.25 pF, 100V, Erie 8101-100-COG-399C
C29	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C30	Capacitor, ceramic, 3.9 pF ±0.25 pF, 100V, Erie 8101-100-COG-399C, nominal value
C31	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8101-100-COG-150J
C32	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C33	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C34	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C35	Capacitor, ceramic, 3.9 pF ±0.25 pF, 100V, Erie 8101-100-COG-399C, nominal value
C36	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C37	Capacitor, ceramic, 3.9 pF ±0.25 pF, 100V, Erie 8101-100-COG-399C
C38	Capacitor, ceramic, 3.3 pF ±0.1 pF, 100V, Erie 8101-100-COG-339B, nominal value
C39	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C40	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8101-100-COG-150J
C41	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C42	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C43	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C44	Capacitor, ceramic, 1.0 pF ±5%, 100V, Erie 8101-100-COG-109J, nominal value
C45	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C46	Capacitor, ceramic, 3.9 pF ±0.25 pF, 100V, Erie 8101-100-COG-399C
C47	Capacitor, ceramic, 3.3 pF ±0.1 pF, 100V, Erie 8101-100-COG-339B, nominal value
C48	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C49	Capacitor, ceramic, 7.5 pF ±0.5 pF, 100V, Erie 8101-100-COG-759D
C50	Capacitor, ceramic, 6.8 pF ±0.25 pF, 100V, Erie 8101-100-COG-689C
C51	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C52	Capacitor, variable, 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237

Replaceable Parts List - A14, Low Frequency Multiplier, continued

Reference Designation	Description
C53	Capacitor, variable 0.8 - 8.5 pF, Voltronic TM-9G or LRC 682237
C54	Capacitor, factory selected
C55	Capacitor, ceramic, 0.22 μF ±20%, 100V, Erie 8131-100-651-224M
C56	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C57	Capacitor, feedthru, 0.001 μF, 1000V, GMV, Erie 2482-001-W5T-102P
C58	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J, nominal value
CR1	Diode, Microdyne 301-476-2
CR2	Diode, Hewlett Packard HPA0112
E1 thru E5	Termination, standoff, teflon, Sealectro ST-SM-1
J1 thru J4	Connector, Sealectro UG1619/U
J5	Connector, Omni-Spectra OSM211
L1	Inductor, variable, LRC 681210
L2	Inductor, Microdyne 203-081
L3	Inductor, Microdyne 202-746
L4	Inductor, 0.33 μH, Jeffers 4425-1M
L5	Inductor, Microdyne 203-080
L6	Inductor, 10 μH, Jeffers 4445-2K
L7	Inductor, Microdyne 203-080
L8	Inductor, 10 μH, Jeffers 4445-2K
L9	Inductor, Microdyne 203-080
L10	Inductor, Microdyne 203-080
L11	Inductor, 10 μH, Jeffers 4445-2K
L12	Inductor, Microdyne 200-324
L13	Inductor, part of R28
L14	Inductor, Microdyne 200-324
L15	Inductor, Microdyne 203-214
L16	Inductor, Microdyne 200-714
L17	Inductor, 10 μH, Jeffers 4445-2K
L18	Inductor, 10 μH, Jeffers 4445-2K

Replaceable Parts List - A14, Low Frequency Multiplier, continued

Reference Designation	Description
Q1 thru Q5	Transistor, npn, RCA 2N5179
Q6	Transistor, npn, RCA 2N5187
Q7	Transistor, npn, RCA 2N5187
R1	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015, nominal value
R2	Resistor, fixed composition, 18Ω ±5%, ¼w, Allen Bradley CB1805, nominal value
R3	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015, nominal value
R4	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R5	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R6	Resistor, fixed composition, 560Ω ±5%, ¼w, Allen Bradley CB5615
R7	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R8	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R9	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R10	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R11	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R12	Resistor, 499Ω, RN55D4990F
R13	Resistor, 1KΩ, RN55D1001F
R14	Resistor, 4.53KΩ, RN55D4531F
R15	Resistor, 4.53KΩ, RN55D4531F
R16	Resistor, 10KΩ, RN55D1002F
R17	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R18	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R19	Resistor, fixed composition, 560Ω ±5%, ¼w, Allen Bradley CB5615
R20	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R21	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley, CB5605, nominal value
R22	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R23	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R24	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605, nominal value
R25	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R26	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R27	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605
R28	Resistor, fixed composition, 22MΩ ±5%, ¼w, Allen Bradley CB2265
R29	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R30	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R31	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115, nominal value

Replaceable Parts List - A14, Low Frequency Multiplier, continued

Reference Designation	Description
TP1	Connector, Sealectro UG1619/U
XQ1 thru XQ5	Socket, transistor, Augat 8060-1G8
XQ6	Retainer, transistor, Augat TXP1803B
XQ7	Retainer, transistor, Augat TXP1803B

A15, Remote Decoder

Reference Designation	Description
C1	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C2	Capacitor, ceramic, 100 pF ±20%, 100V, Erie 8131-100-COG-101J
C3 thru C22	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C23 thru C25	Capacitor, tantalum, 10 pF ±20%, 20V, Kemet T362B106M020AS
E1 thru E32	Termination, disconnect pin, AMP 61067-1
R1	Not Assigned
R2 thru R10	Potentiometer, 5K, Beckman 66WR5K
R11 thru R16	Potentiometer, 2K, Beckman 66WR2K
R17	Not Assigned
R18	Potentiometer, 1K, Beckman 66WR1K
R19	Potentiometer, 2K, Beckman 66WR2K
R20	Potentiometer, 2K, Beckman 66WR2K
R21	Potentiometer, 5K, Beckman 66WR5K

Replaceable Parts List - A15, Remote Decoder, continued

Reference Designation	Description
R22 thru R26	Potentiometer, 2K, Beckman 66WR2K
R27	Not Assigned
R28	Potentiometer, 2K, Beckman 66WR2K
R29	Not Assigned
R30	Not Assigned
R31	Resistor, precision, 34.8K ±1%, RN553482F
R32	Not Assigned
R33	Resistor, precision, 28.7K ±1%, RN552872F
R34	Resistor, precision, 30.9K ±1%, RN55D3092F, nominal value
R35	Resistor, precision, 23.2K ±1%, RN55D2322F, nominal value
R36	Resistor, precision, 20.0K ±1%, RN55D2002F, nominal value
R37	Resistor, precision, 23.2K ±1%, RN552322F
R38	Resistor, precision, 20.0K ±1%, RN55D2002F, nominal value
R39	Resistor, precision, 26.7K ±1%, RN55D2672F, nominal value
R40	Resistor, precision, 20.0K ±1%, RN55D2002F, nominal value
R41	Resistor, precision, 25.5K ±1%, RN55D2552F, nominal value
R42	Resistor, precision, 21.0K ±1%, RN552102F
R43	Resistor, precision, 16.5K ±1%, RN551652F
R44	Resistor, precision, 17.8K ±1%, RN551782F
R45	Resistor, precision, 18.7K ±1%, RN55D1872F, nominal value
R46	Resistor, precision, 17.8K ±1%, RN55D1782F, nominal value
R47	Resistor, precision, 10.0K ±1%, RN55E1002F, (must be RN55E)
R48	Resistor, precision, 150K ±1%, RN55D1503F
R49	Resistor, precision, 150K ±1%, RN55D1503F
R50	Resistor, precision, 15.0K ±1%, RN55D1502F, nominal value
R51	Resistor, precision, 15.8K ±1%, RN55D1582F, nominal value
R52	Resistor, precision, 13.0K ±1%, RN55D1302F, nominal value
R53	Resistor, precision, 14.0K ±1%, RN55D1402F, nominal value
R54	Resistor, precision, 11.8K ±1%, RN55D1182F, nominal value
R55	Resistor, precision, 13.0K ±1%, RN55D1302F, nominal value
R56	Not Assigned
R57	Resistor, precision, 12.1K ±1%, RN55D1212F, nominal value
R58	Not Assigned
R59	Resistor, precision, 13.0K ±1%, RN55D1302F, nominal value
R60	Not Assigned
R61	Resistor, precision, 13.0K ±1%, RN55D1302F, nominal value
R62 thru R66	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
U1	Quad, 2 lines to 1 line, Data Selector/Multiplier, Texas Instrument SN74157N

Replaceable Parts List - A15, Remote Decoder, continued

Reference Designation	Description
U2	Quad, 2 lines to 1 line, Data Selector/Multiplier, Texas Instrument SN74157N
U3 thru U5	Jumper Wire Socket, Microdyne 203-337
U6	Binary to BCD Converter, Texas Instrument SN74184
U7	4 line to 10 line Decoder, Texas Instrument SN7442
U8	4 line to 10 line Decoder, Texas Instrument SN7442
U9	Hex Inverter, Texas Instrument SN7404N
U10	Hex Inverter, Texas Instrument SN7404N
U11 thru U17	4-Channel Driver, Inter-Sel. DG172CJ
U18	Operational Amplifier, National LM308N
XU1	Socket, 16 pin, Augat 516-AG11D
XU2	Socket, 16 pin, Augat 516-AG11D
XU3	Socket, 14 pin, Augat 514-AG11D
XU4	Socket, 14 pin, Augat 514-AG11D
XU5	Socket, 14 pin, Augat 514-AG11D
XU6	Socket, 16 pin, Augat 516-AG11D
XU7	Socket, 16 pin, Augat 516-AG11D
XU8	Socket, 16 pin, Augat 516-AG11D
XU9 thru XU17	Socket, 14 pin, Augat 514-AG11D
XU18	Socket, 8 pin, Augat 508AG11D

A16, Channel Select Display

Reference Designation	Description
C1	Capacitor, tantalum, 47 pF, 10V, Kemet T362C476010AS
C2	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
E1 thru E10	Termination, disconnect pin, AMP 61067-1
U1	Indicator, Hewlett Packard HP5082-7300
U2	Indicator, Hewlett Packard HP5082-7300
XU1	Socket, 24-pin, Augat 524AG11D

MAINTENANCE DRAWINGS

This section of the booklet contains the component location drawings for the printed-circuit board assemblies and the schematic-wiring diagrams for the RF Tuner. Unless otherwise specified, the following information applies to each schematic diagram:

a. Capacitor values greater than 1.0 are in picofarads.

b. Capacitor values less than 1.0 are in microfarads.

c. Inductor values are in microhenrys.

d. Resistor values are in ohms: k = x 1000; m = x 1,000,000.

e. * denotes selected value.

f. ferrite bead.

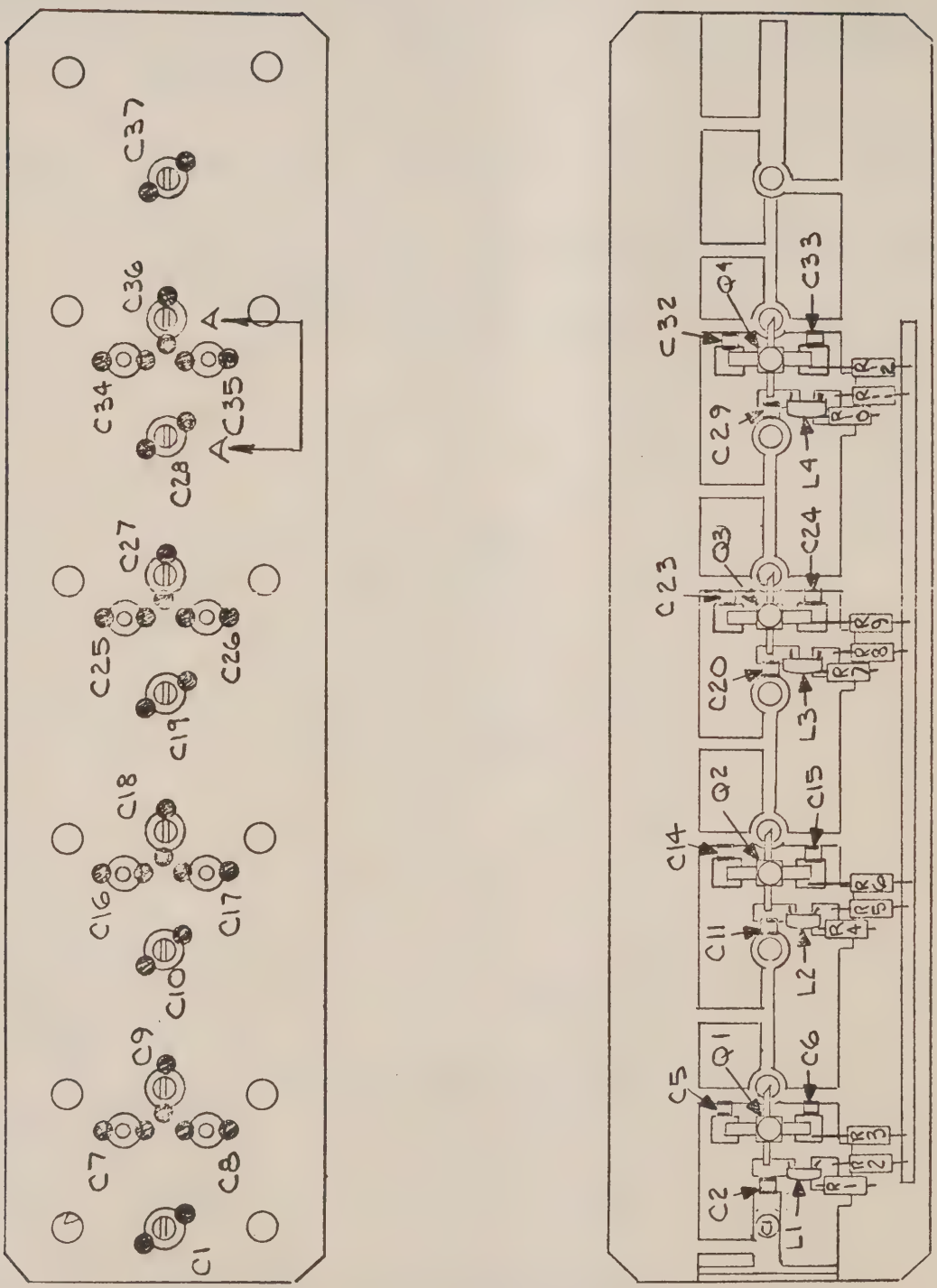


Figure 1. A1, Preamplifier, Component Location Drawing

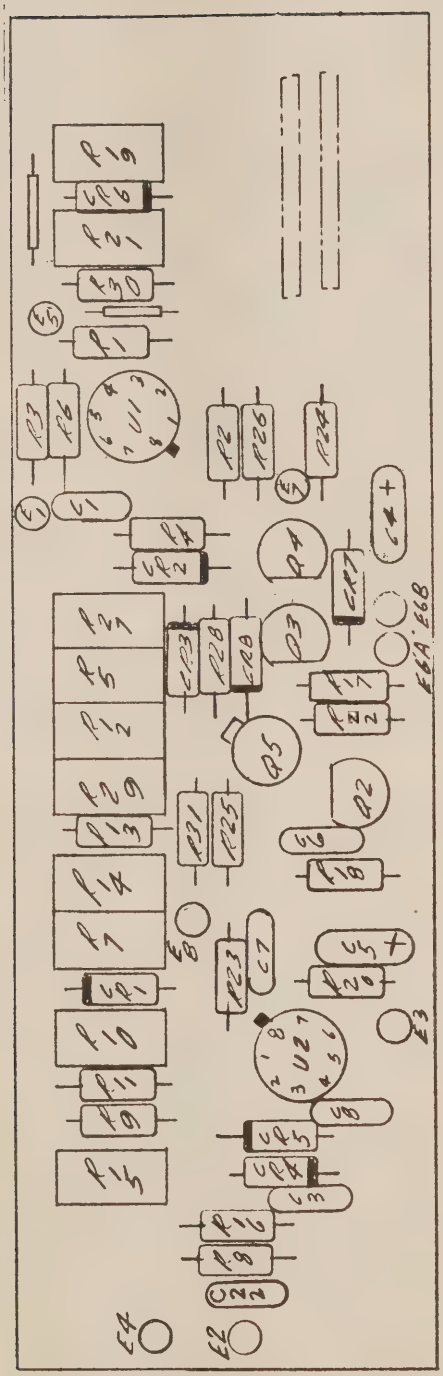


Figure 2. A3, DC Control Board,
Component Location Drawing

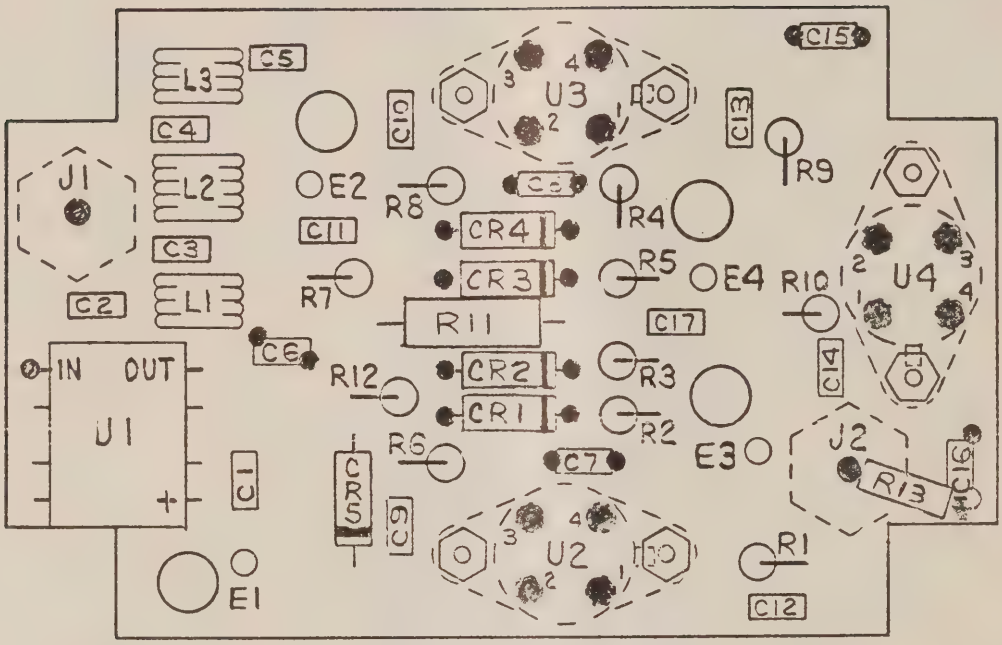


Figure 3. A7, 70 MHz Gain Control Amplifier, Component Location Drawing

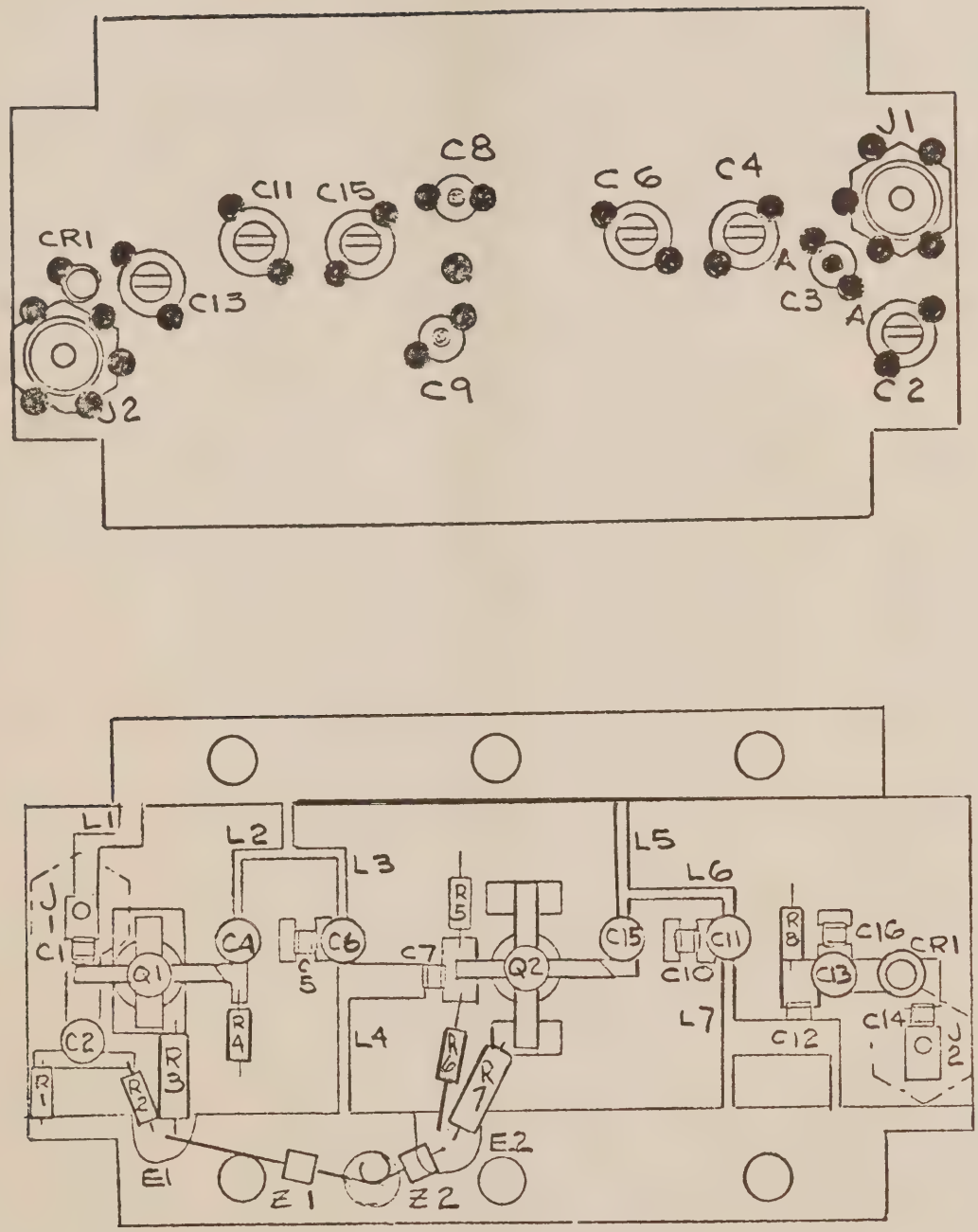
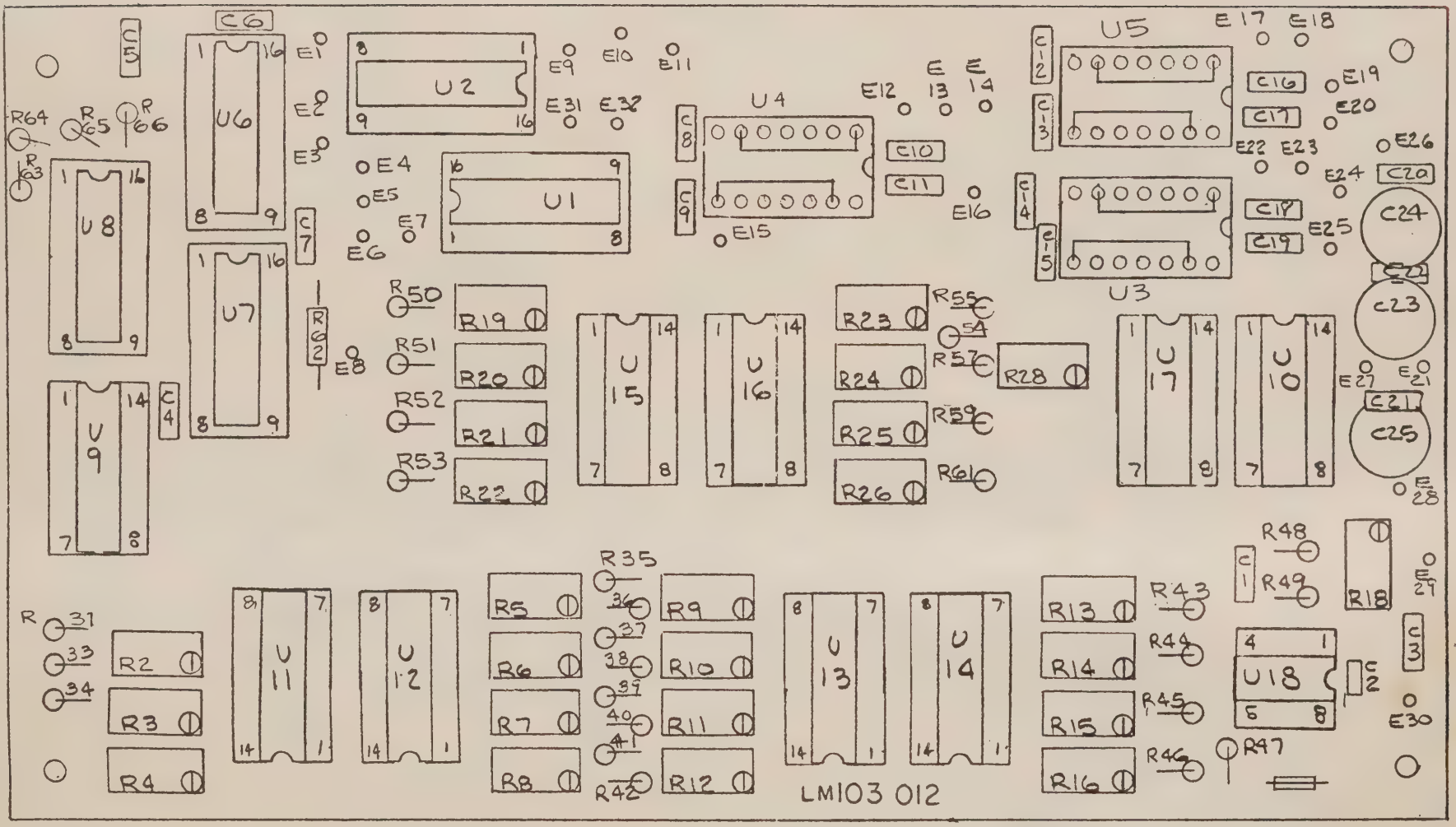


Figure 4. A11, X4 Multiplier,
Component Location Drawing



NOTE:
U3, U4, U5 provided only in tuners used in dual chassis receivers which employ the dual line receivers for remote distances.

Figure 5. A15, Remote-Local Decoder, Component Location Drawing

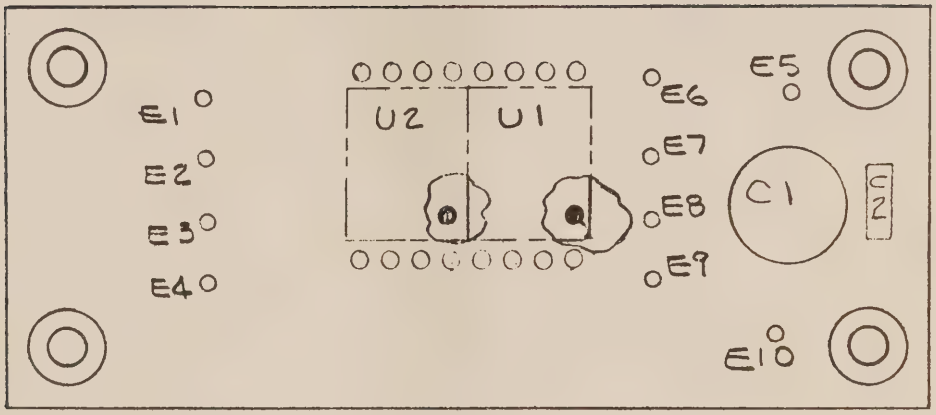


Figure 6. A16, Channel Select Display, Component Location Drawing

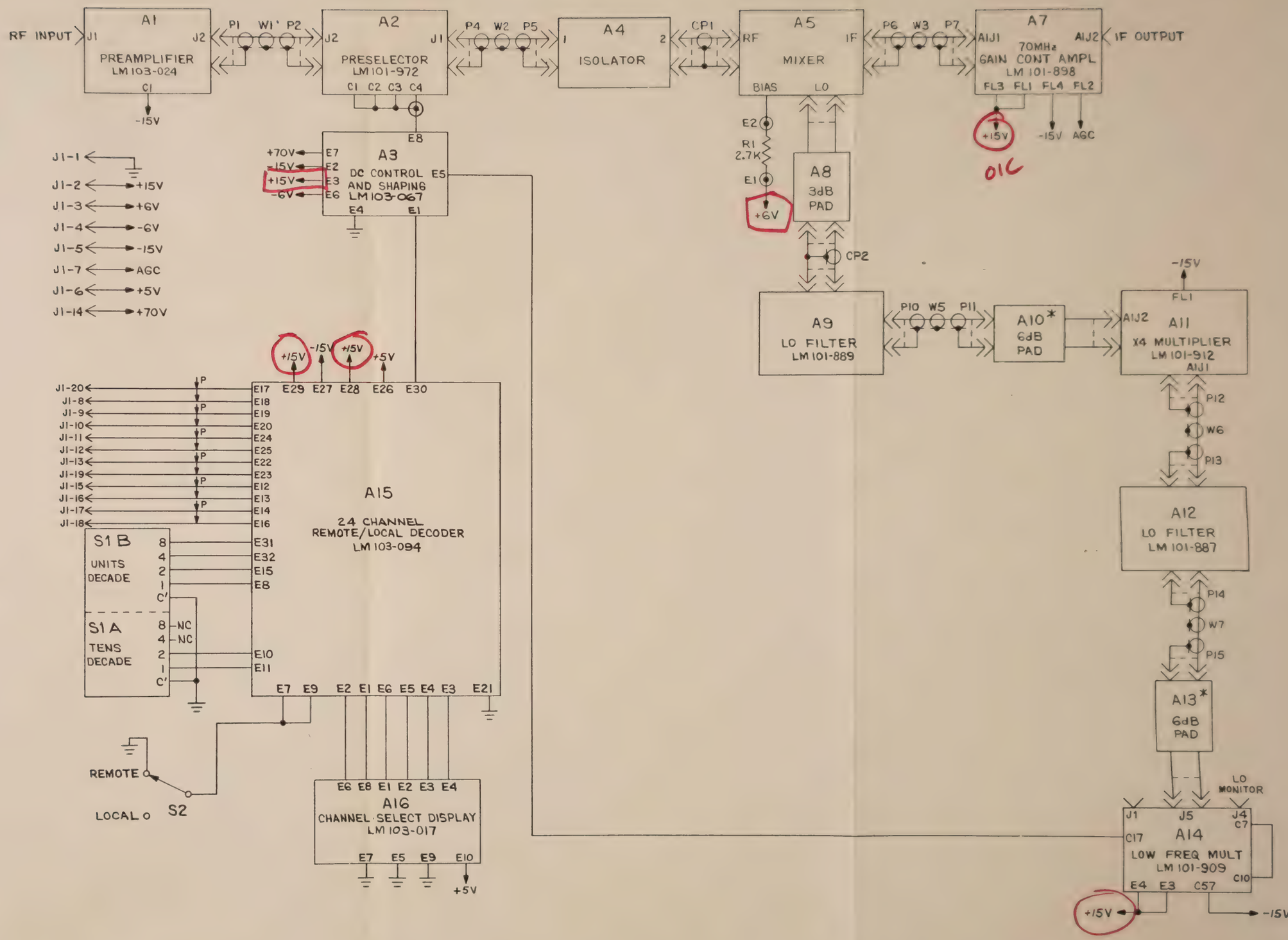


Figure 7. Main Chassis, Wiring Diagram

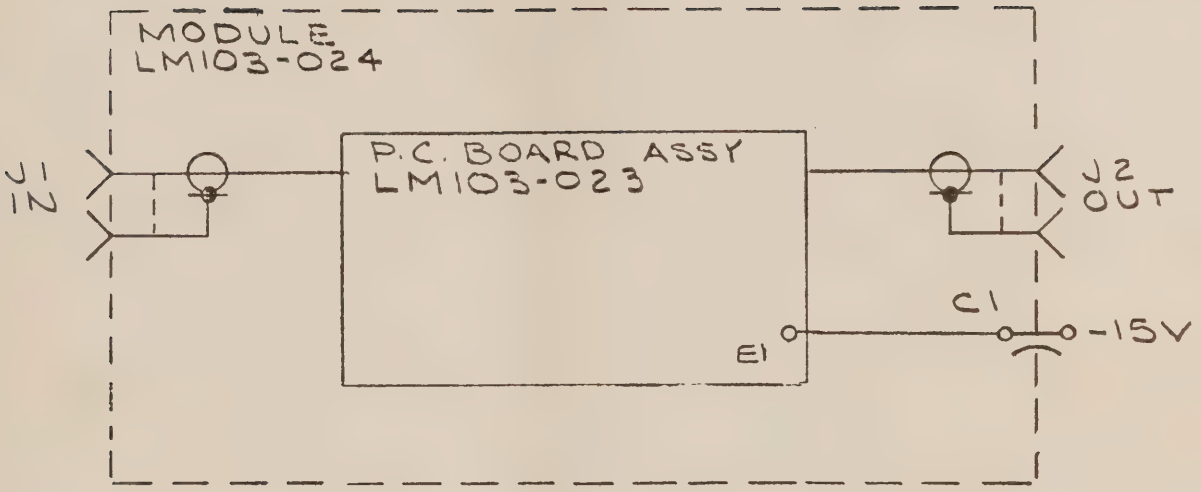


Figure 8. A1, Preamplifier Module, Wiring Diagram

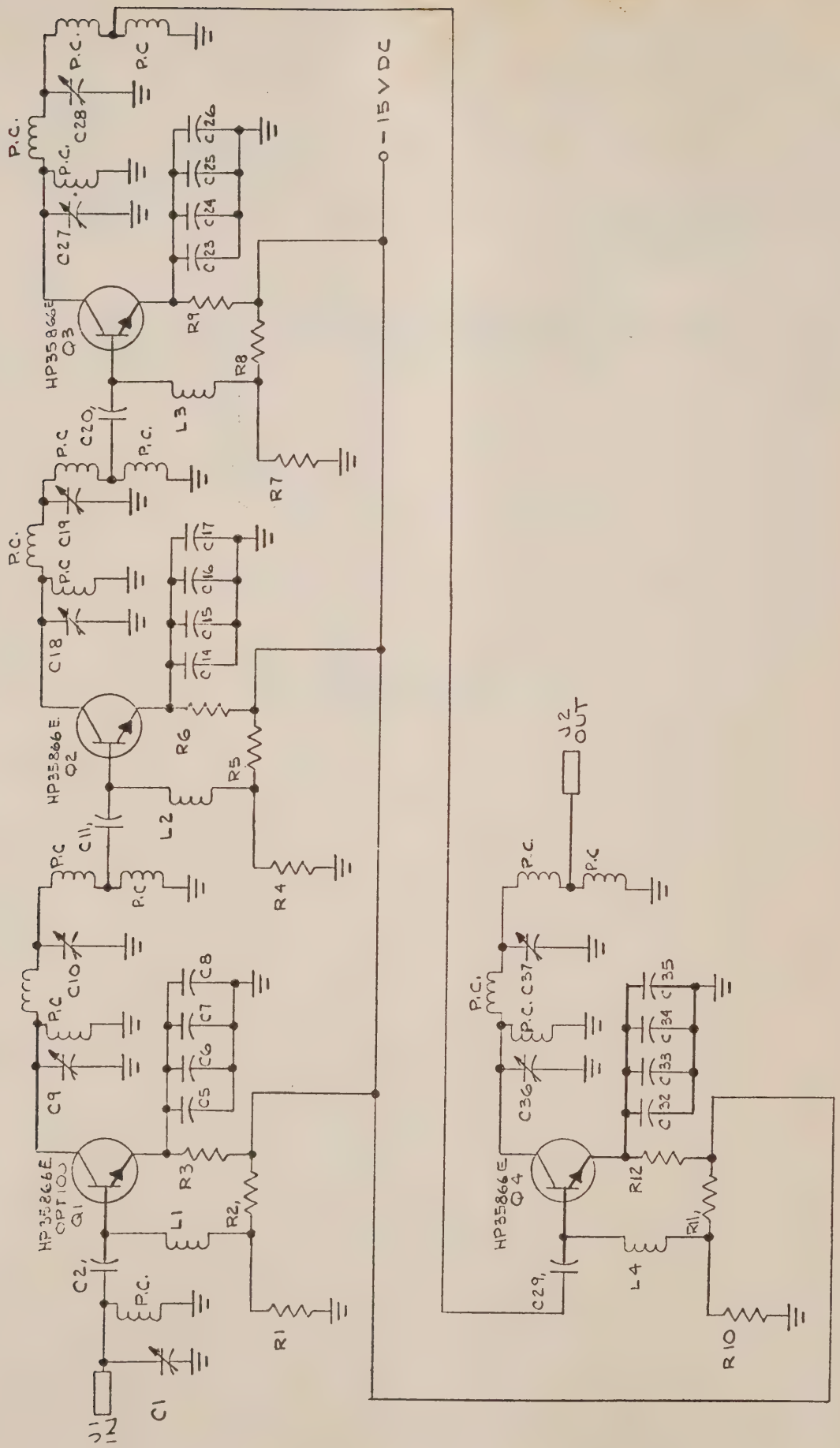
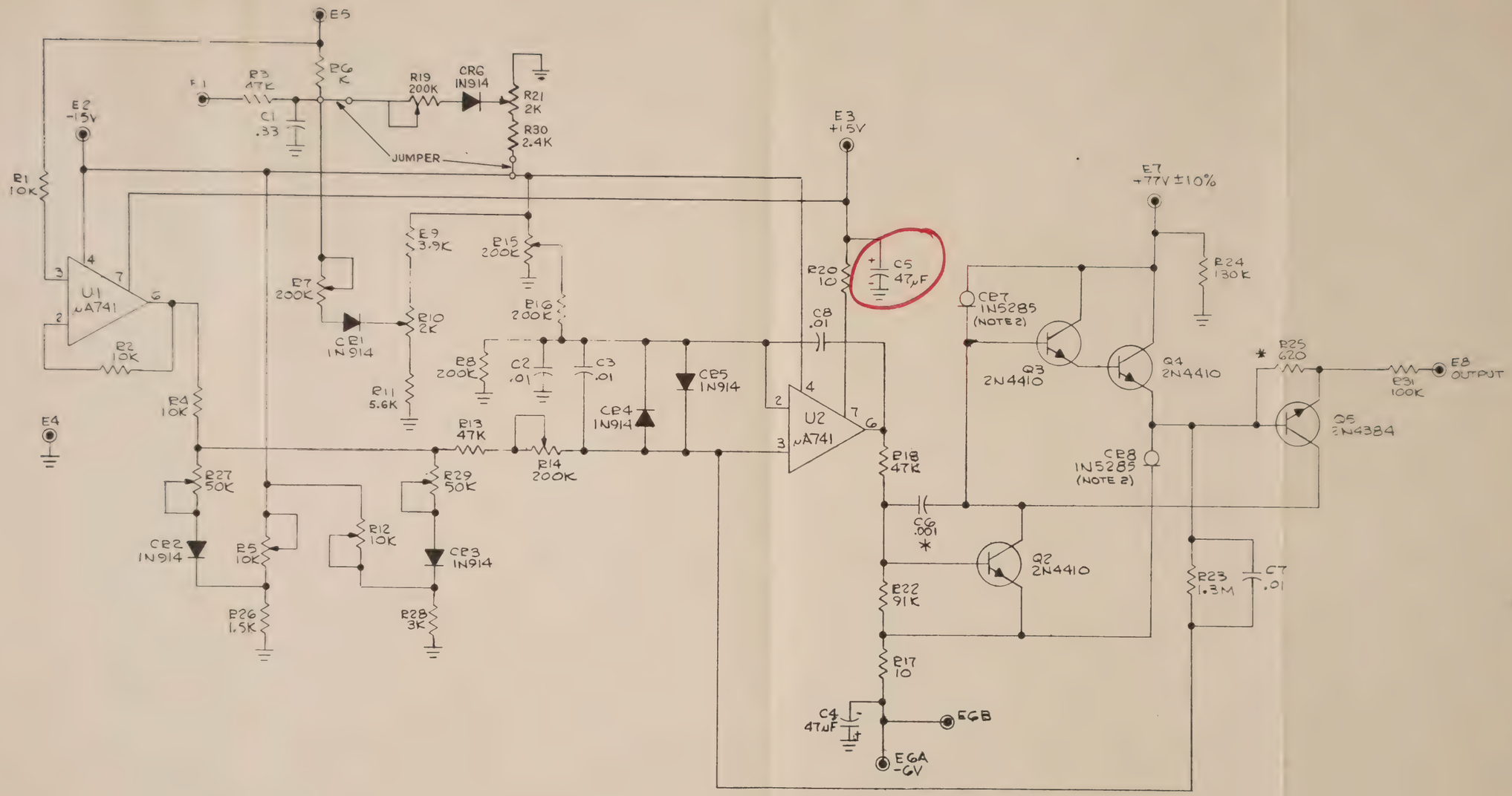


Figure 9. A1A1, Preamplifier Printed Circuit Board, Schematic Diagram



NOTE:
1. UNLESS OTHERWISE NOTED
   CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
   CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
   INDUCTANCE VALUES ARE IN MICROHENRYS.
   RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.
2. IN5283 THRU IN5290 MAY BE USED FOR CR7 & CR8.
* FACTORY SELECTED VALUE.

HIGHEST REFERENCE DESIGNATION USED			
A2	C8	CR8	R8
R31	Q5		
REFERENCE DESIG NOT USED			
CR6	R19	R21	Q1
R30			

Figure 10. A3, DC Control Board, Schematic Diagram

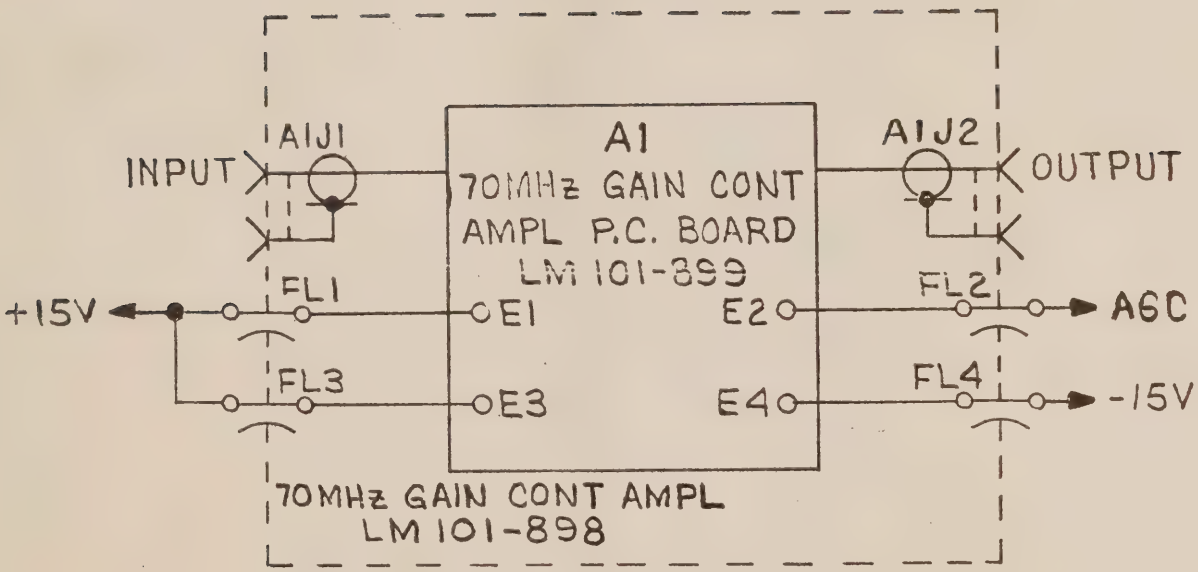


Figure 11. A7, 70 MHz Gain Control Amplifier, Module Wiring Diagram

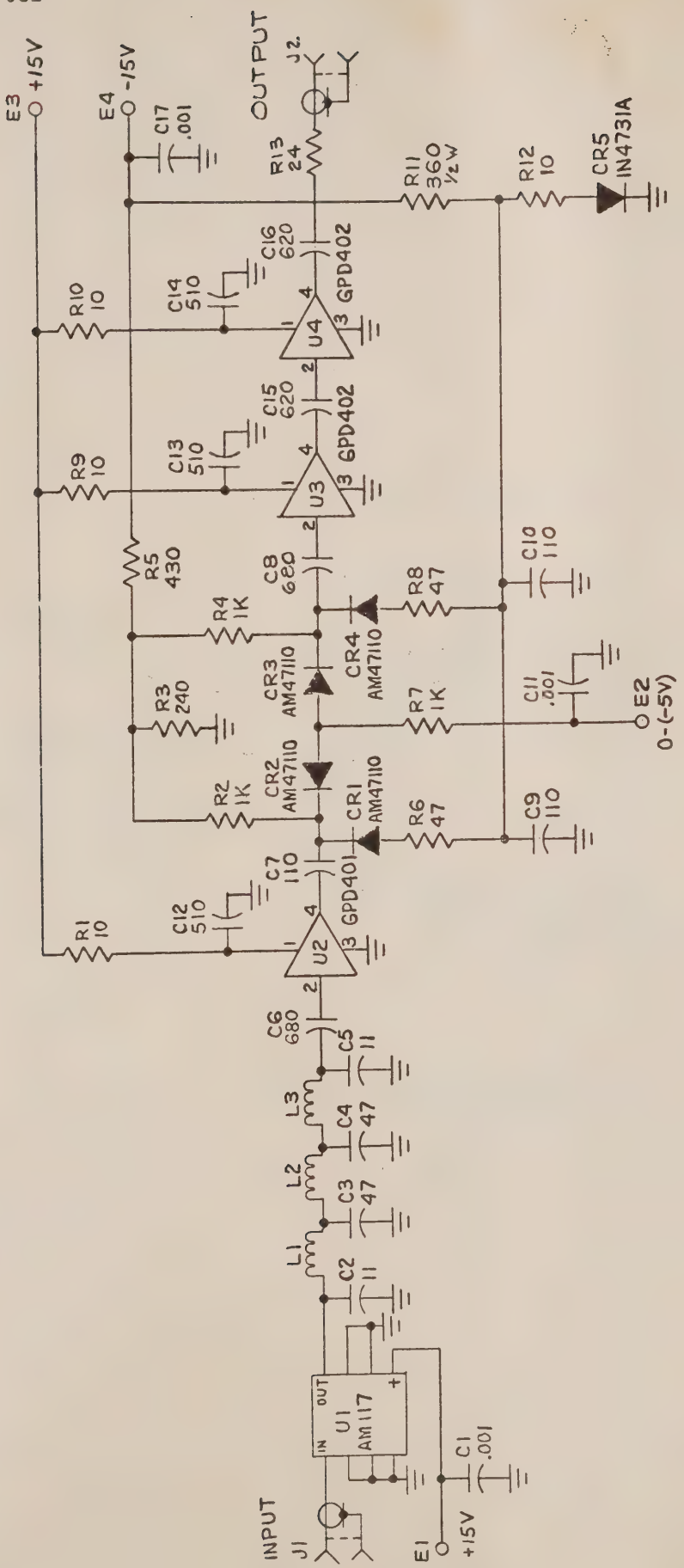


Figure 12. A7A1, 70 MHz Amplifier, Schematic Diagram

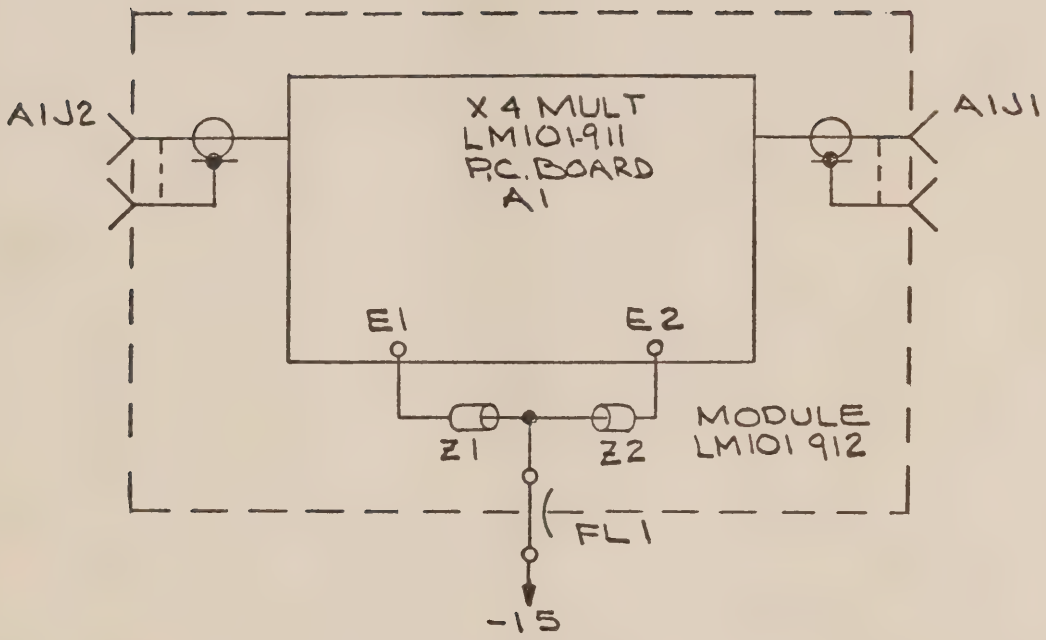


Figure 13. A11, X4 Multiplier, Module Wiring Diagram

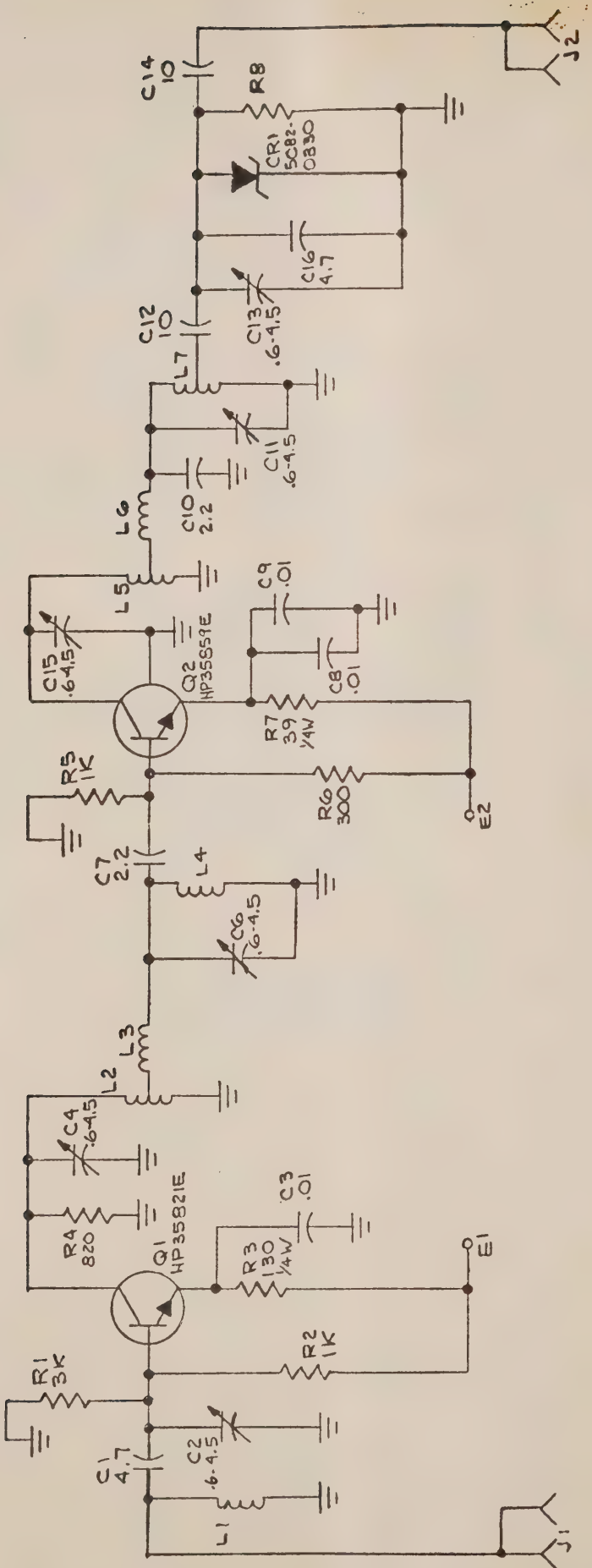
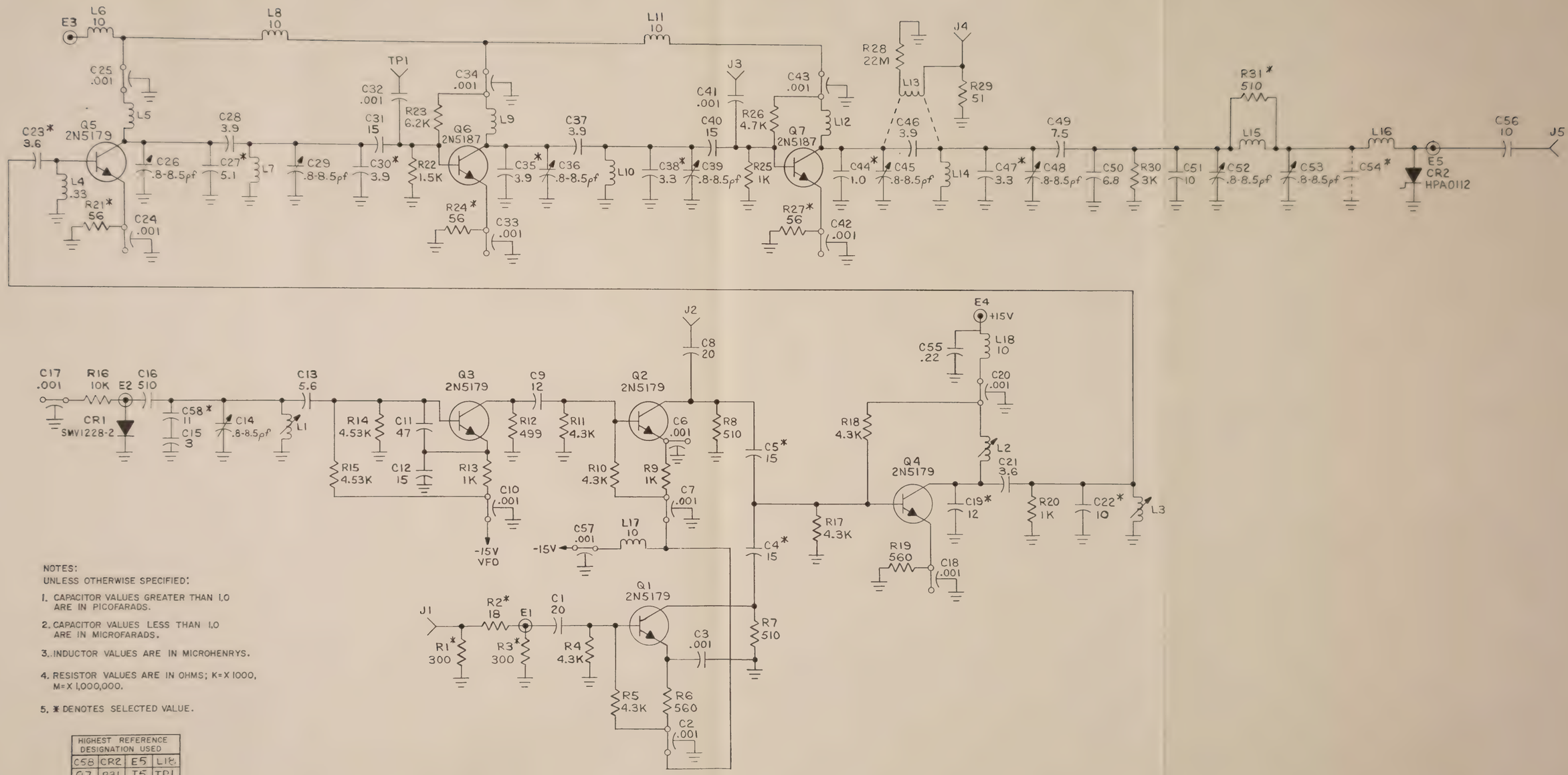


Figure 14. A11A1, X4 Multiplier, Schematic Diagram

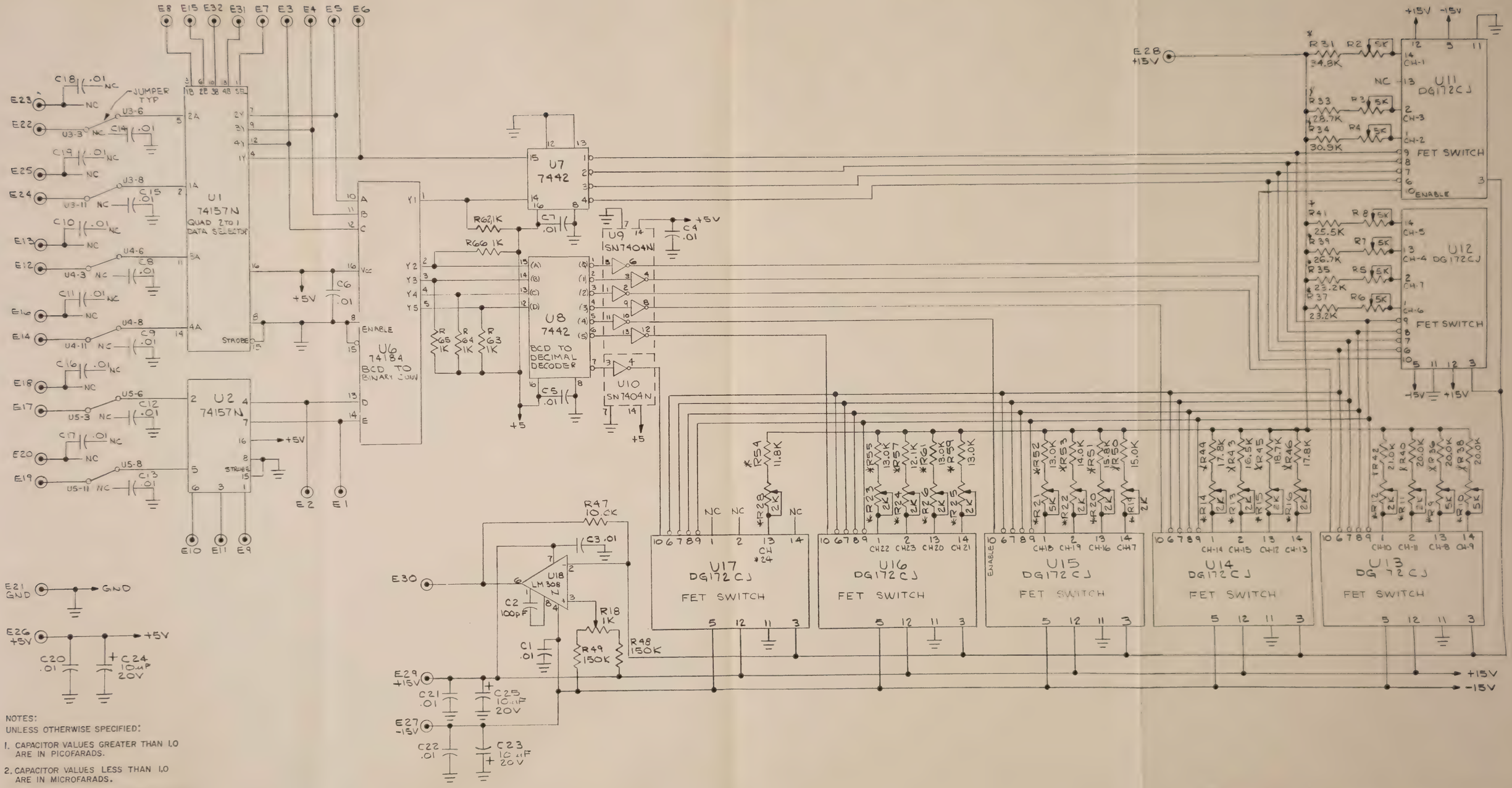


NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. * DENOTES SELECTED VALUE.

HIGHEST REFERENCE DESIGNATION USED			
C58	CR2	E5	L18
Q7	R31	J5	TP1
REFERENCE DESIGNATION NOT USED			

Figure 15. A14, Low Frequency Multiplier, Schematic Diagram



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
4. * DENOTES SELECTED VALUE.

Figure 16. A15, Remote/Local Decoder, Schematic Diagram

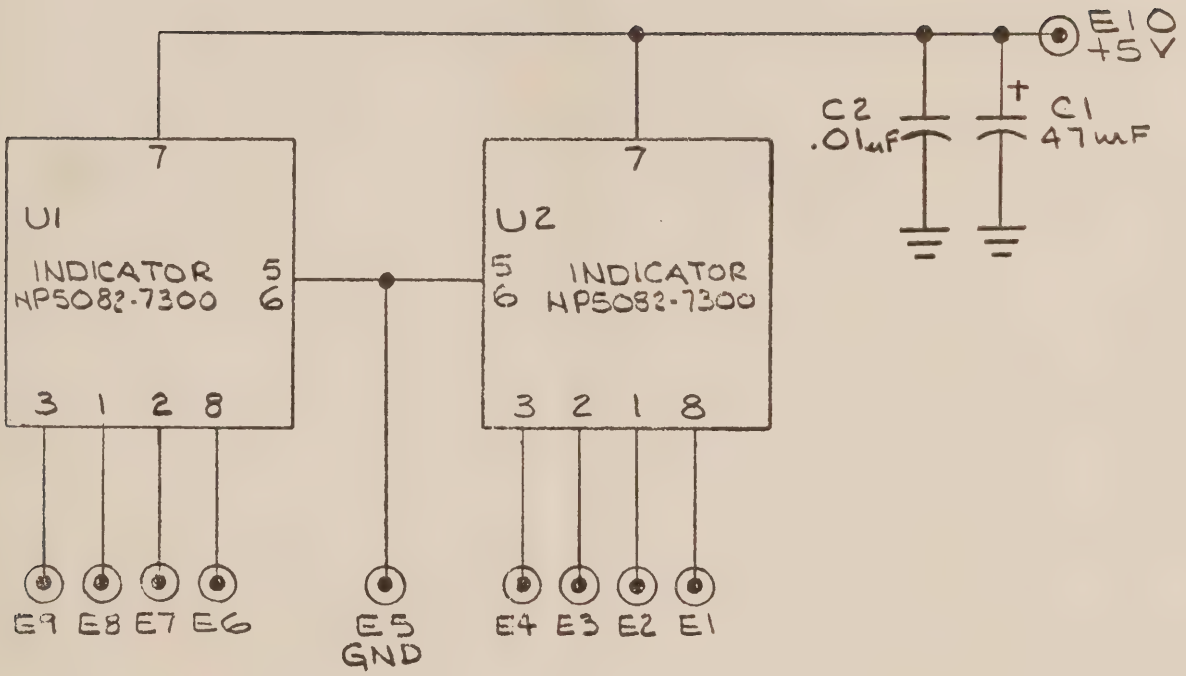


Figure 17. A16, Channel Select Display, Schematic Diagram

Instruction Booklet

101-938 AGC AMPLIFIER

October 1975

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MICRODYNE Corporation

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Telephone (301) 762-8500

EQUIPMENT MODIFICATION

The AGC Amplifier has been modified to increase the zeroing range of the signal strength (level) meter of the parent receiver. The modification includes:

Changing the value of R8 from 51K to 30K, Allen Bradley CB3035.

Changing the value of R9 from 8.2K to 1.0K, Allen Bradley CB1025.

Deleting C12 and C13 from the back of the PC Board, (68 pF).

AGC AMPLIFIER

GENERAL

The 101-938 AGC Amplifier module is designed for use with Microdyne telemetry equipment. Module circuitry is composed of an agc amplifier, an agc record amplifier, and a carrier operated relay (cor). The agc amplifier portion of the circuit is driven by an output from the a-m detector and is used to control the gain of the tuner, second mixer, and second i-f filter/amplifier. It also drives the signal level meter on the parent unit front panel, the agc record amplifier, and cor amplifier. The agc record amplifier circuit supplies a voltage output for application to an external recorder or diversity combiner. In order to provide an indication of carrier reception, the agc voltage also controls a relay circuit which operates in conjunction with the parent unit threshold control and carrier indicator lamp. The threshold control sets the point at which the relay circuit is energized to illuminate the lamp. A schematic of the module is shown in figure 2.

INSTALLATION

No definite installation procedures can be applied to the agc amplifier since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedure.

THEORY OF OPERATION

The agc amplifier consists of the agc record amplifier U1, Q1-Q2; cor amplifier U2, Q3; and agc integrator U3, Q4-Q5. Gain control voltages originate in the a-m detector and are processed by the agc amplifier module to control the signal level at the rf tuner, second mixer, and the second i-f filter/amplifier. The agc module also provides outputs to the signal level meter, carrier indicator, and the rear panel record output. Refer to the circuit schematic diagram, figure 2.

The nominal +1.5V dc a-m detector output is coupled through pin F to U3-2 and a +1.5V reference level is applied to U3-3. Any differences between the two inputs, which are measured in microvolts, are amplified by approximately 100 dB in U3. The resultant 0 to -5V dc output is coupled through buffer amplifier Q4-Q5 to the module output at pin N and to the cor amplifier U2. Additional outputs are applied to the receiver signal level ZERO control via pin M and the 60 dB calibrate control via pin 14.

The response time of U3 is determined by the positioning of the receiver AGC TIME CONSTANT MSEC switch. This switch contains a number of resistors which are configured with C3, C4, C5, and R30 to provide time constants of 0.1, 1.0, 10, 100, and 1000 milliseconds. The output of U3 is also clamped by CR3 to prevent agc levels more positive than +2V dc.

A portion of the agc output is applied to cor amplifier U2 which functions as a regenerative switch to control the receiver CARRIER INDICATOR lamp. In a no signal state, the positive output of U2 holds Q3 in a cutoff condition preventing an output at pin L. When the receiver

is tuned to a signal above the threshold level, the output of U3 causes the output of U2 to switch to a negative voltage thereby turning on Q3. The level at which U2 switches from negative to positive is determined by the receiver COR THRESHOLD adjustment which is felt through pin P. With Q3 conducting, +15V dc is coupled through CR2 to the CARRIER INDICATOR lamp via pin L. The conduction of Q3 also energizes relay K1, providing contact operation at pins 6, 8, 9, 10, H, J which may be used to control external indicators via the parent unit ACCESSORIES connector.

The setting of the parent base unit AGC RECORD POLARITY switch sets the configuration of U1 as an inverting (+ setting) or a non-inverting amplifier)-setting) by routing the agc voltage to pin 2 or 3 of U1 (respectively) and grounding the other pin through the input resistor. See the parent unit wiring-schematic diagram for interface connections.

The ZERO and SCALE controls are utilized to set the agc record output to ±12V maximum for compatibility with external equipment. Setup procedures are given in the parent unit instruction manual. The output of U1 is applied to the output amplifier Q1-Q2 which drives the agc record output at pin R.

MAINTENANCE

PREVENTIVE MAINTENANCE

The only preventive maintenance requirement is a semiannual check of the module for loose components and corrosion. Any discrepancies noted during the inspection should be corrected either by component replacement or by module substitution.

TROUBLESHOOTING

In the event of malfunction, the trouble should first be isolated to one of the three independent circuits; the AGC integrator, the COR amplifier or the AGC RECORD amplifier. To determine the faulty circuit, set the receiver OPERATE MODE switch to PBK, the AGC TIME CONSTANT switch to MAN and place the AGC card on the extender. Connect a DC voltmeter to pin N of the extender and adjust the receiver MAN GAIN control for a VM indication of -0.5(±0.1)V DC. (Inability to make this adjustment indicates a fault in the AGC integrator.) Connect the DC VM to pin P of the extender and adjust the receiver COR THRESHOLD for a VM indication of 5.0(±0.1)V DC. Inability to make this adjustment indicates a fault in the COR stage. Connect the DC VM to pin R of the extender. Set the receiver AGC RECORD POLARITY (on the rear apron) to + and adjust the AGC RECORD ZERO for a VM indication of 0(±0.1)V DC. (Inability to make this adjustment indicates a fault in the AGC record amplifier.)

Using Voltage Chart #1, the schematic and component location diagram, check the circuit operation.

NOTE that some of the voltages are measured relative to card terminals which were previously set.

Voltage Chart #1

Device/Pin	1	2	3	4	5	6	7	8
U1	-15	0	0	-15	-15	R ±.03	+15	0
U2	-15	- .56	- .18	-15	-15	1 -.30	+15	0
U3	-15	+1.5	+1.5	-15	-15	N -.04	+15	0

	E	B	C
Q1	R +.15	R +.75	1 - .55
Q2	R -.15	R -.75	15 + .55
Q3	+15	+15	-15
Q4	N +.08	N +.70	1 -1.65
Q5	N -.12	N -.75	15 + .65

Note: Extender Board Terminals (1), (15), (N), (R) are used as the references for differential measurements.

Set the voltage at extender pin N to -5.0(±0.1)V DC (using the MAN GAIN control). Adjust the AGC RECORD SCALE (on the rear apron) for +10.0(±0.1)V DC at extender pin R. Check for proper circuit operation using Voltage Chart #2.

Voltage Chart #2

Device/Pin	1	2	3	4	5	6	7	8
U1	-15	0	0	-15	-15	R + .6	+15	0
U2	-15	- .58	-1.9	-15	-15	-13	+15	0
U3	-15	+1.5	+1.5	-15	-15	N -.55	+15	0

	E	B	C
Q1	R +.15	R + .75	1 - .8
Q2	R -.15	R - .75	15 + .6
Q3	1 -.25	1 -1.0	1 - .4
Q4	N ±.1	N + .45	1 - .2
Q5	N -.35	N -1.0	15 +1.8

Note: Extender Board Terminals (1), (15), (N), (R) are used as the references for differential measurements.

ALIGNMENT

After the fault has been located and corrected, the module should be tested for proper operation. The test equipment necessary for alignment is as follows:

Extender Card	Microdyne 300-423
Signal Generator	Compatible with rf tuner
DC Voltmeter	HP312A

Procedure:

a. Apply a 50 MHz, -50 dBm signal to the receiver with an HP606A signal generator.

b. The receiver agc output level at pin N should be from -3V to -3.5V.

c. The output at pin L should cause the front panel CARRIER INDICATOR lamp to go on.

d. When the input is varied, the agc record output should vary. If the agc amplifier outputs are not present, refer to the voltage chart.

NOTE

When part replacement does not remedy the problem, it is recommended that the agc card be returned to the Microdyne Corporation.

REPLACEABLE PARTS LIST (Reference Figure 1.)

Reference Designation	Description
C1	Capacitor, tantalum, 47 μF ±10%, 35V, Union Carbide T362D476K035AS
C2	Capacitor, tantalum, 47 μF ±10%, 35V, Union Carbide T362D476K035AS
C3	Capacitor, tantalum, 100 μF ±10%, 20V, Union Carbide T362D107K020AS
C4	Capacitor, tantalum, 10 μF ±10%, 25V, Union Carbide T360B106K025AS
C5	Capacitor, tantalum, 1 μF ±10%, 35V, Union Carbide T360A105K035AS
C6	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, tantalum, 330 μF ±10%, 6V, Union Carbide T362D337K006AS
C8	Capacitor, ceramic, 47 pF ±20%, 100V, Erie 8101-100-X5R-470M
C9	Capacitor, tantalum, 2.2 μF ±10%, 20V, Union Carbide T360A225K020AS
C10	Capacitor, paper, 0.1 μF ±10%, 80V, Sprague 192P1049R8
C11	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8101-100-X5R-221M
C12	Capacitor, ceramic, 68 pF ±5%, 100V, Erie 8131-100-COG-680J
C13	Capacitor, ceramic, 68 pF ±5%, 100V, Erie 8131-100-COG-680J
CR1	Diode, silicon, rectifier, JEDEC 1N4001
CR2	Diode, silicon, rectifier, JEDEC 1N4001
CR3	Diode, silicon, signal, JEDEC 1N914

Replaceable Parts List, continued

Reference Designation	Description
K1	Relay, DPDT, G.E. 3SAV5004L1
L1	Inductor, 82 μH ±5%, Airco Speer 1315-10J
L2	Inductor, 82 μH ±5%, Airco Speer 1315-10J
Q1	Transistor, npn, Si, To-18, JEDEC 2N2222
Q2	Transistor, pnp, Si, To-18, JEDEC 2N2907
Q3	Transistor, pnp, Si, To-18, JEDEC 2N2907
Q4	Transistor, npn, Si, To-18, JEDEC 2N2222
Q5	Transistor, pnp, Si, To-5, JEDEC 2N2905
R1	Not Assigned
R2	Not Assigned
R3	Resistor, fixed composition, 1.6KΩ ±5%, ¼w, Allen Bradley CB1625
R4	Resistor, fixed composition, 36KΩ ±5%, ¼w, Allen Bradley CB3635
R5	Resistor, fixed composition, 7.5KΩ ±5%, ¼w, Allen Bradley CB7525
R6	Resistor, fixed composition, 36KΩ ±5%, ¼w, Allen Bradley CB3635
R7	Resistor, fixed composition, 7.5KΩ ±5%, ¼w, Allen Bradley CB7525
R8	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R9	Resistor, fixed composition, 8.2KΩ ±5%, ¼w, Allen Bradley CB8225
R10	Resistor, fixed composition, 18KΩ ±5%, ¼w, Allen Bradley CB1835
R11	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R12	Not Assigned
R13	Resistor, precision, 6.19KΩ ±1%, 1/8w, MIL RN55D6191F
R14	Resistor, precision, 332Ω ±1%, 1/8w, MIL RN55D3320F
R15	Resistor, precision, 332Ω ±1%, 1/8w, MIL RN55D3320F
R16	Resistor, precision, 6.19KΩ ±1%, 1/8w, MIL RN55D6191F
R17	Resistor, fixed composition, 110Ω ±5%, 2w, Allen Bradley HB1115
R18	Resistor, fixed composition, 30Ω ±5%, 1/2w, Allen Bradley EB3005
R19	Resistor, fixed composition, 30Ω ±5%, 1/2w, Allen Bradley EB3005
R20	Resistor, fixed composition, 110Ω ±5%, 2w, Allen Bradley HB1115
R21	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R22	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R23	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R24	Resistor, fixed composition, 3.9KΩ ±5%, ¼w, Allen Bradley CB3925
R25	Resistor, fixed composition, 3.0MΩ ±5%, ¼w, Allen Bradley CB3055
R26	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R27	Resistor, fixed composition, 15KΩ ±5%, ¼w, Allen Bradley CB1535
R28	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R29	Resistor, fixed composition, 47Ω ±5%, 1/8w, Allen Bradley BB4705
R30	Resistor, fixed composition, 5.6KΩ ±5%, ¼w, Allen Bradley CB5625
R31	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125

Replaceable Parts List, continued

Reference Designation	Description
R32	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R33	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R34	Resistor, precision, 8.25KΩ ±1%, 1/8w, MIL RN55D8251F
R35	Resistor, precision, 432Ω ±1%, 1/8w, MIL RN55D4320F
R36	Resistor, precision, 432Ω ±1%, 1/8w, MIL RN55D4320F
R37	Resistor, precision, 8.25KΩ ±1%, 1/8w, MIL RN55D8251F
R38	Resistor, fixed composition, 560Ω ±5%, 1/2w, Allen Bradley EB5615
R39	Resistor, fixed composition, 30Ω ±5%, ¼w, Allen Bradley CB3005
R40	Resistor, fixed composition, 30Ω ±5%, ¼w, Allen Bradley CB3005
R41	Resistor, fixed composition, 150Ω ±5%, 2w, Allen Bradley HB1515
U1	Operational Amplifier, G.P., Mini Dip, Nat'l Semi LM741CN
U2	Operational Amplifier, G.P., Mini Dip, Nat'l Semi LM741CN
U3	Operational Amplifier, G.P., Mini Dip, Nat'l Semi LM741CN
XQ1 to XQ5	Transipad to 5, to 18, Milton Ross 10109,(10044 may be used in place of 10109)
XK1	Transipad, relay, Milton Ross 10105
XU1 thru XU3	Socket, 8 pin, Mini Dip, Augat 508-AG1D

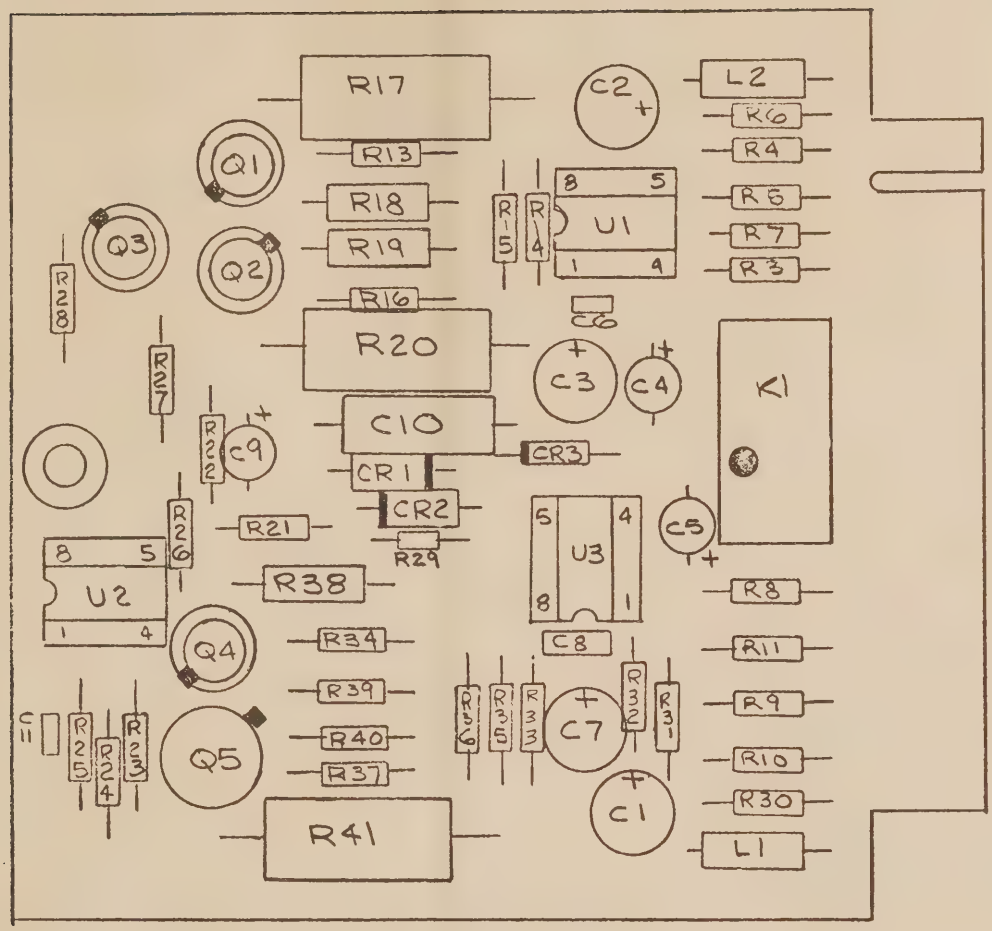
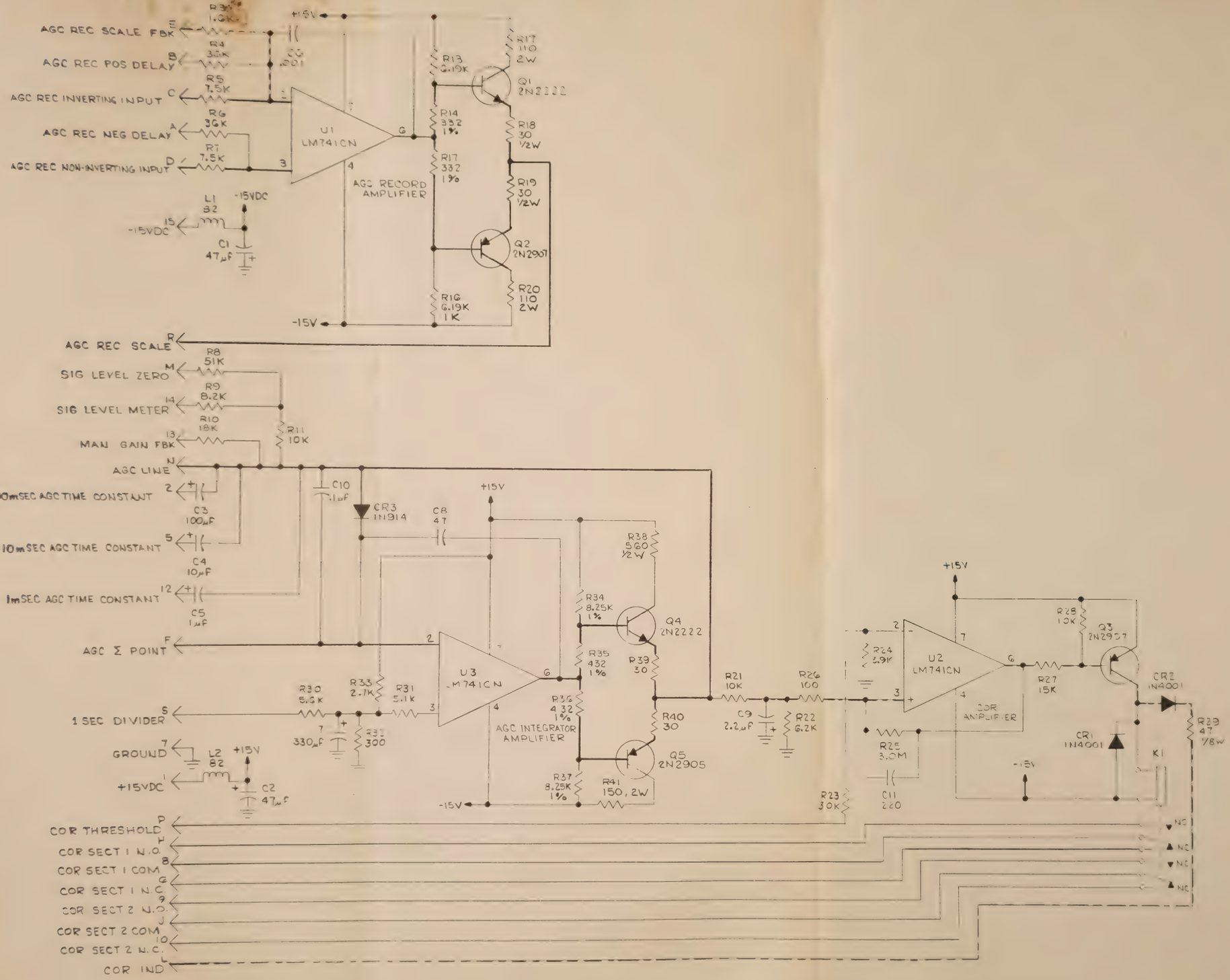


Figure 1. Component Location Drawing



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. LINE INFORMATION:
   - SIGNAL FLOW
   - FEEDBACK
   - COR SIGNAL

Figure 2. AGC Amplifier, Schematic Diagram

Instruction Booklet

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101-994
70 MHz FM DEMODULATOR

April 1976

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MICRODYNE Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
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70 MHz FM DEMODULATOR

GENERAL

The 101-994 FM Demodulator is a wideband unit that accepts a 70 MHz IF signal and provides a composite video output and a baseband video output. The demodulator also outputs an agc sensor voltage. The demodulator is especially designed for use in the Microdyne series of TV/satellite receivers.

INSTALLATION

No definite procedures are applicable to the module since it can be installed in various parent units. Any special procedure required to install the module will be specified in the parent unit instruction manual under Repair and Replacement.

THEORY OF OPERATION

Reference figure 2, schematic diagram of the demodulator board. The 70 MHz IF signal (pre-emphasized FM TV signal) is applied to E1 of the board. This signal level is nominally 40 mV. The 70 MHz IF signal is coupled from E1 to amplifier-limiters U1A, U1B, U2A, and U2B. The limited signal is transformer coupled to the demodulator at a level of approximately +5 dBm.

The video output of the demodulator is routed through a low pass filter, L20-C39-C40, to video amplifier U3. U3 can be configured as an inverting or a non-inverting amplifier by coupling the signal to either E16 (inverting) or E19 (non-inverting). The output of E3 is made available at E20 for application to the receiver's video circuitry. The output of U3 is also applied to buffer amplifier Q7 which drives the baseband output at E28. Both video outputs have an impedance of 75 ohms.

The agc detector comprises Q1 through Q6. The 70 MHz IF signal is amplified by cascaded IF amplifiers Q1, Q2, and Q3. The amplified signal is detected by a voltage doubler type detector consisting of diodes CR1 and CR2. The detected signal is applied to amplifier Q4 whose output level is (present at E29) nominally +5.0V DC for a 40 mV IF signal at E1. This +5.0V DC detected signal is then offset by Q5 and Q6 to provide a nominal +1.5V at E5. E5 is the agc sensor output of the demodulator, the voltage at which is routed to the agc amplifier(s) in the parent unit.

MAINTENANCE

The following test equipment is required to service and maintain the demodulator; equivalent test equipment may be used.

DC Voltmeter	HP412
Signal Generator	HP608
Sweep Generator	HP VS-50
Two 24 ohm coax. inline resistors	
Oscilloscope	HP1201AR
Two 75 ohm loads	
RF Detector	HP8471A
Step Attenuators	HP355D, HP355C
RF Millivoltmeter	HP411

PREVENTIVE MAINTENANCE

The preventive maintenance requirements for the FM Demodulator is limited to a semi-annual check of:

a. Wiring for cut, cracked, and frayed insulation.

b. Connectors for hardware tightness. Tighten all loose connectors and hardware to prevent signal loss and short circuits.

c. Corroded Connectors. Corroded connectors should be replaced, although they may be cleaned using fine grade emery cloth.

TROUBLESHOOTING

In the event of a malfunction in the FM Demodulator, using an oscilloscope, monitor the signal at the various termination points in the module. This should enable the isolation of the fault to a particular stage or area. The alignment procedures as given in this booklet may also be used as a troubleshooting guide.

ALIGNMENT

The FM Demodulator may be aligned while installed in the receiver. Realignment is recommended after any repair is made to the circuitry.

a. Disconnect the cables connected to J1, J2, and J3 of the module. Release the quarter-turn fasteners on the module and lift the module out of the receiver chassis. The cabling attached to connector J4 will allow the demodulator to be placed in a position that permits access to the circuitry. Remove the cover from the module.

b. Connect the VERT and HORIZ outputs of the sweep generator to the corresponding inputs of the oscilloscope.

c. Connect the RF OUT of the sweep generator to an HP355D step attenuator and the output of the 355D to an HP355C step attenuator. Connect the output of the 355C to a 24 ohm resistor.

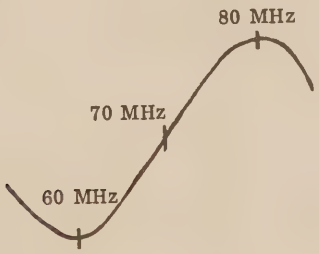
d. Connect a 75 ohm load across the HP411 RF millivoltmeter and connect it to the 24 ohm resistor connected to the HP355C attenuator. Set the 355D and the 355C attenuators for 0 dB. Set the output of the sweep generator to CW and adjust its RF output level for 0 dB as indicated on the HP411.

e. Set the sweep generator to Wide Band Sweep centered at 70 MHz. Disconnect the HP411 and connect the sweep generator (24 ohm resistor) to J1 on the FM demodulator.

f. Connect the VIDEO input of the sweep generator loaded with 75 ohms to J2 on the FM demodulator.

g. Apply power to the receiver.

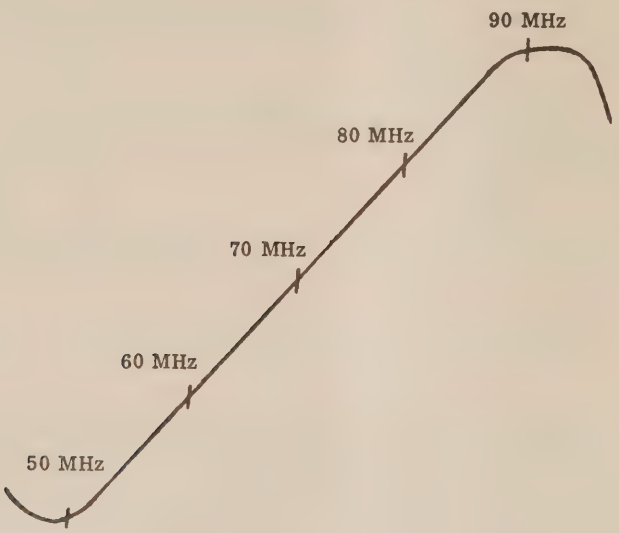
h. Note the waveform (S curve) as shown on the oscilloscope. On the sweep generator, apply the 10 MHz markers. Adjust the HP355D and HP355C step attenuators for a response similar to that shown below. If necessary, adjust L14 and L15 in the demodulator module.



i. Note the attenuator settings necessary to obtain the desired response. The limiter stages in the demodulator are operating in the linear region at this level, and this is a check of the limiter gain. The attenuator settings should be greater than 40 dB.

j. Decrease the attenuator pad settings to 4 dB. Ground the oscilloscope input and adjust the vertical position so the trace passes through the center vertical graticule. Set the oscilloscope to DC coupled and adjust the zero control, R51 in the demodulator until the 70 MHz marker on the S curve passes through the center graticule.

k. Note the output S curve. This is the normal operating level. The S curve should appear as shown below. The S curve should be linear from 55 MHz to 85 MHz.



l. Note the output level on the S curve. The level from 70 to 80 MHz should be +0.5(±0.1)V.

The level from 70 to 60 MHz should be -0.5(±0.1)V.

m. Disconnect the video output of the sweep generator from J2 and reconnect it to J3, the baseband output. Note the waveform is the same as in step l.

n. Disconnect the sweep generator from the FM demodulator.

o. Set the HP608 signal generator to 70 MHz, CW. Connect a 24 ohm coax inline resistor to the RF output. Connect an HP411 voltmeter loaded with 75 ohms, to the 24 ohm resistor, and adjust the output of the HP608 for -5 dBm on the HP411.

p. Disconnect the HP411 and connect the HP608 with the 24 ohm resistor, to the IF input of the FM demodulator, J1.

q. Connect a DC voltmeter to E29 of the demodulator and adjust R66 in the demodulator for +5.0V DC at E29.

r. Move the DC voltmeter to E5 and adjust R72 for +1.5V DC at E5.

This completes the alignment and test of the demodulator module. Remove power from the receiver and disconnect the test equipment. Replace the demodulator in the receiver.

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer, and manufacturer's part number for each electrical component used in the FM Demodulator. Include all information when ordering spare or replaceable components.

Module Housing

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 101-992; see paragraph below for breakdown listing
J1	Connector, p/o W1, Phelps Dodge 700171
J2	Connector, p/o W2, Phelps Dodge 700171
J3	Connector, p/o W3, Phelps Dodge 700171
J4	Connector, AMP 205204-1
W1	Cable Assembly, Microdyne 203-297-6
W2	Cable Assembly, Microdyne 203-297-8
W3	Cable Assembly, Microdyne 203-297-13
Z1 thru Z5	Ferrite Bead, Fair-Rite 2673000101

Printed Circuit Board Assembly

Reference Designation	Description
A1	Demodulator, Microdyne 103-006; nonrepairable
C1 thru C30	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C31	Capacitor, 0.39 pF ±10%, Quality Components MCO.39
C32	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C33	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C34	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C35	Capacitor, ceramic, 24 pF ±5%, 100V, Erie 8121-100-COG-240J
C36 thru C38	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C39	Capacitor, ceramic, 120 pF ±5%, 100V, Erie 8121-100-COG-121J
C40	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J
C41	Capacitor, 0.22 pF ±10%, Quality Components MCO.22
C42	Capacitor, ceramic, 0.33 µF ±20%, 100V, Erie 8131-100-651-334M

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
C43	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C44	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C45	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C46	Capacitor, tantalum, 47 μF ±20%, 35V, Kemet T360D476K035AS
C47	Capacitor, tantalum, 47 μF ±20%, 35V, Kemet T360D476K035AS
C48	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C49	Not Assigned
C50 thru C52	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C53	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C54 thru C57	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C58	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
C59	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
C60	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C61	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C62	Capacitor, ceramic, 2700 pF ±20%, 100V, Erie 8131-100-X5R-272M
C63	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
CR1	Diode, germanium, Sylvania 1N277
CR2	Diode, germanium, Sylvania 1N277
CR3	Diode, silicon, Sylvania 1N914
CR4	Diode, silicon, Sylvania 1N914
CR5	Diode, silicon, Sylvania 1N914
E1	Termination, cable, part of W1
E2 thru E5	Termination, AMP 61067-1
E6 thru E8	Termination, solder, USECO 2021B
E9	Not Assigned
E10	Not Assigned
E11 thru E19	Termination, solder, USECO 2021B

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
E20	Termination, cable, part of W2
E21 thru E27	Termination, AMP 61067-1
E28	Termination, cable, part of W3
E29 thru E31	Termination, AMP 61067-1
L1	Not Assigned
L2	Not Assigned
L3 thru L13	Inductor, fixed, 6.8 μH ±10%, Jeffers 4435-2K
L14	Inductor, variable, 0.15 μH, Cambion 7107-03
L15	Inductor, variable, 0.15 μH, Cambion 7107-03
L16	Inductor, fixed, 0.15 μH, Microdyne 203-231
L17	Inductor, fixed, 0.15 μH, Microdyne 203-231
L18	Inductor, fixed, 0.15 μH, Microdyne 203-233
L19	Inductor, fixed, 0.15 μH, Microdyne 203-233
L20	Inductor, fixed, 3.3 μH, Jeffers 4425-12K
L21	Inductor, fixed, 220 μH ±10%, Jeffers 1315-20J
L22	Inductor, fixed, 220 μH ±10%, Jeffers 1315-20J
L23	Inductor, fixed, 6.8 μH ±10%, Jeffers 4435-2K
L24	Inductor, fixed, 6.8 μH ±10%, Jeffers 4435-2K
Q1	Transistor, silicon, npn, 2N5179
Q2	Transistor, silicon, npn, 2N5179
Q3	Transistor, silicon, npn, 2N5179
Q4	Transistor, silicon, pnp, 2N3906
Q5	Transistor, silicon, npn, 2N3904
Q6	Transistor, silicon, npn, 2N3904
Q7	Transistor, dual pnp-npn, Sprague TD602
R1	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R2	Resistor, fixed composition, 18Ω ±5%, ¼w, Allen Bradley CB1805
R3	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R4	Resistor, fixed composition, 150Ω ±5%, ¼w, Allen Bradley CB1515
R5	Resistor, fixed composition, 150Ω ±5%, ¼w, Allen Bradley CB1515
R6	Not Assigned
R7	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R8	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R9	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R10	Resistor, fixed composition, 160Ω ±5%, ¼w, Allen Bradley CB1615

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
R11	Resistor, fixed composition, 390Ω ±5%, ¼w, Allen Bradley CB3915
R12	Resistor, fixed composition, 390Ω ±5%, ¼w, Allen Bradley CB3915
R13	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R14	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R15	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R16	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R17	Resistor, fixed composition, 160Ω ±5%, ¼w, Allen Bradley CB1615
R18	Resistor, part of L16
R19	Resistor, part of L17
R20	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R21	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R22	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R23	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R24	Resistor, part of L18
R25	Resistor, part of L19
R26 thru R28	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R29	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R30	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R31	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R32	Not Assigned
R33	Resistor, fixed composition, 62Ω ±5%, ¼w, Allen Bradley CB6205
R34	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R35	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R36	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R37	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R38	Resistor, fixed composition, 24Ω ±5%, ¼w, Allen Bradley CB2405
R39	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605
R40	Resistor, fixed composition, 24Ω ±5%, ¼w, Allen Bradley CB2405
R41	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R42	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R43	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R44	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R45	Not Assigned
R46	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R47	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R48 thru R50	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R51	Potentiometer, cermet, 5K ±10%, 1/2w, Beckman 66XR5K
R52	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R53	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R54	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R55	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R56	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
R57	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R58	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R59	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R60	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R61	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R62	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R63	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R64	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R65	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R66	Potentiometer, cermet, 500Ω ±10%, 1/2w, Beckman 66WR500
R67	Resistor, fixed composition, 68Ω ±5%, ¼w, Allen Bradley CB6805
R68	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R69	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R70	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1025
R71	Resistor, fixed composition, 1.8KΩ ±5%, ¼w, Allen Bradley CB1825
R72	Potentiometer, cermet, 5K ±10%, 1/2w, Beckman 66WR5K
R73	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R74	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R75	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R76	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R77	Sensister, 1/8w, 5%, Ropon DG125822J
R78	Resistor, fixed composition, 1.8KΩ ±5%, ¼w, Allen Bradley CB1825
R79	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R80	Resistor, fixed composition, 160Ω ±5%, ¼w, Allen Bradley CB1615
R81 thru R86	Resistor, fixed composition, 110Ω ±5%, ¼w, Allen Bradley CB1115
R87	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R88	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R89	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
T1	RF Transformer, Mini-Ckts T4-1
U1	Integrated circuit, dual diff. amp, RCA CA3049
U2	Integrated circuit, dual diff. amp, RCA CA3049
U3	Operational amplifier, Optical Electronics 9804

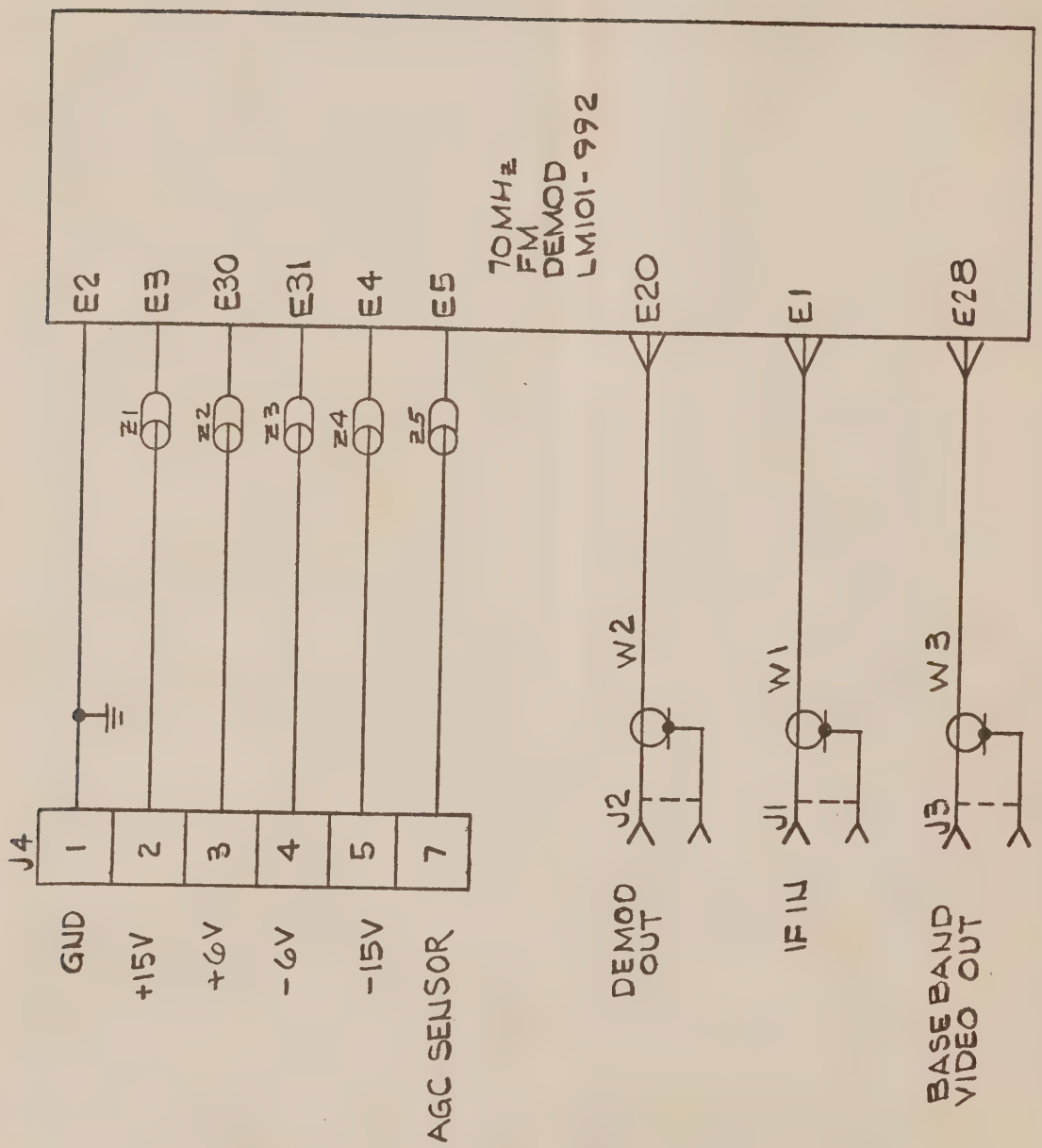


Figure 1. Module Wiring Diagram

DEMODULATOR LM103-006

NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS, K=X 1000, M=X 1,000,000.

Figure 2. 70 MHz FM Demodulator, Schematic Diagram

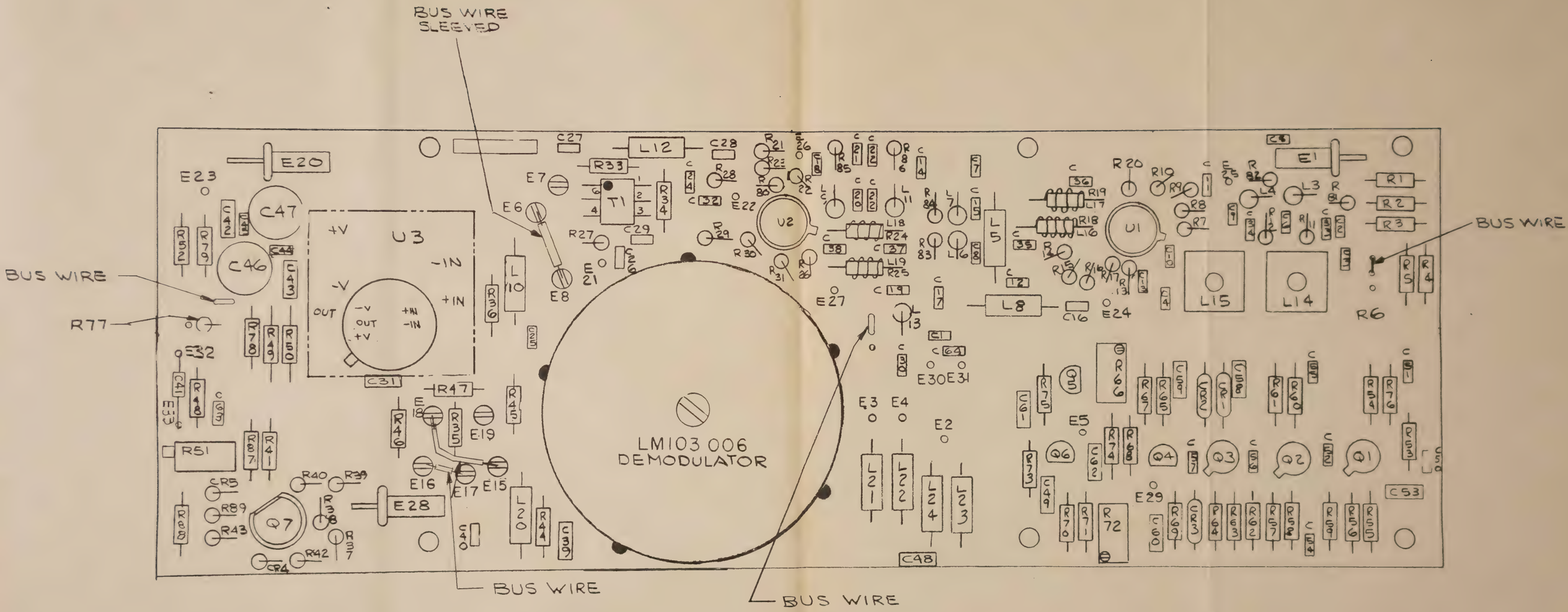


Figure 3. Printed Circuit Board, Component Location Drawing

Instruction Booklet

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101-995
IF AMPLIFIER/EQUALIZER

April 1976

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ERRATA

The following change(s) should be inserted into the instruction booklet prior to its use in servicing and/or maintaining the IF Amplifier/Equalizer module.

Replaceable Parts List

R32 is changed from 510Ω to 330Ω, CB3315

101-995 IF AMPLIFIER/EQUALIZER

GENERAL

The 101-995 IF Amplifier/Equalizer module is used in Microdyne's wideband receivers to establish a 70 MHz i-f bandwidth of 40 MHz at the -3 dB points. The amplifier exhibits an overall gain of 35 dB. The module also contains an equalizer network that ensures phase linearity across the passband.

INSTALLATION

No definite installation procedure can be applied to the module as it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual under Repair and Replacement.

THEORY OF OPERATION

Reference figure 2, schematic diagram of the amplifier subassembly. The 70 MHz i-f signal is applied to A2 of the module and coupled to a dual gate fet input amplifier arrayed in a grounded gate configuration. Output from this stage is coupled to the first of four gain-controlled common source amplifiers, Q2, Q4, Q6, and Q8. The i-f signal is applied to gate 1 and the agc voltage from J1 is applied to gate 2 of the amplifier stages. A double-tuned circuit is used between each stage.

Transistors Q3, Q5, and Q7 function as buffer amplifiers providing the required 50 ohms input for the Q4, Q6, and Q8. Buffer amplifier Q9 provides the drive for the equalizer network consisting of L33, C65 through C68 and R64 through R67. The equalizer network ensures optimum phase linearity across the 40 MHz passband. Q12 functions as the output buffer amplifier. The amplifier module exhibits an overall gain of 35 dB with a -0.5V agc and unity gain with -5V agc.

U1 functions as the agc buffer amplifier. R54 is the gain control and R56 is the agc slope control.

MAINTENANCE

The following test equipment is required for servicing and maintaining the amplifier module; equivalent equipment may be used:

DC VTVM	Fluke 8000A	24-ohm Coaxial Adapter Cables (2)	Solder a 24-ohm, $\frac{1}{4}$w, (AB CB2405) resistor between two BNC connectors (1094) with ground lugs attached. Solder the ground lugs together.
Signal Generator	HP608		
Sweep Generator	Wavetek 1050A		
Switchable Attenuators	HP355D, HP355C		
Oscilloscope	HP1200AR		
RF Millivoltmeter	HP411		
50-ohm Detector	Aertech D10		

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the amplifier module consist of a semiannual inspection checking for loose hardware, connectors, and components. Any discrepancies should be corrected immediately to ensure proper operation.

TROUBLESHOOTING

In the event that the module malfunctions, the problem can best be located by attempting an alignment. Once the defective component is located, it should be replaced with an identical component as referenced in the replaceable parts list. Procedures for replacing printed circuit board mounted components are given in the REPAIR section of the receiver manual.

ALIGNMENT

The following procedures are recommended for aligning the amplifier/equalizer module.

a. Release the quarter-turn fasteners that hold the module in place. Position the module so as to permit access to the internal circuitry. Remove the module cover.

b. Disconnect the cabling to connectors J1 and J2; do not disturb the power/agc cabling.

c. Apply power to the parent receiver and place the agc in the Manual mode.

d. Adjust the manual agc control in the parent receiver for -0.5V at E7 of the module. Adjust R54 on the module for +3.6V at E10.

e. Connect the test equipment as follows:

   (1) HP355D and HP355C in series.

   (2) RF Out of sweep generator to the HP355D.

   (3) HP355C to a 24-ohm adapter cable.

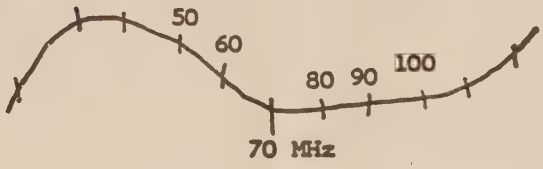
   (4) The Scope VERT and HORIZ outputs of the sweep generator to the corresponding inputs of the oscilloscope.

   (5) The DEMOD output of the sweep generator to the D-10 50-ohm detector, and the detector to a 24-ohm adapter cable. Connect the free end of the adapter cable to E3 of the module.

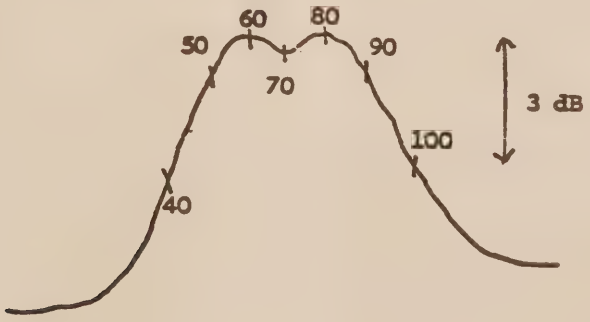
f. Disconnect one end of the capacitor connected between E14 and E15 on the module.

g. Connect the sweep generator (24-ohm adapter cable) to E11/E12 of the module. Set up the generator and oscilloscope for a sweep response, using maximum sweep on the generator. Note the response appears as shown below. Adjust L33 until the 70 MHz marker appears at the center of the dip response.

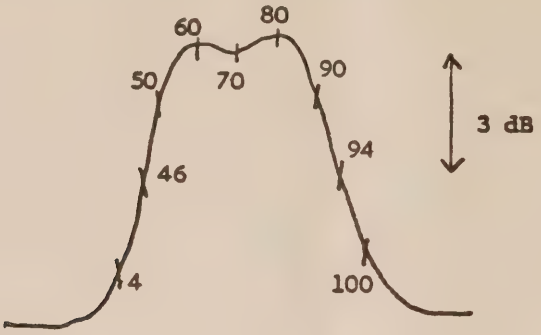
h. Reinstall the capacitor between E14 and E15, and adjust L32 for the response shown below.



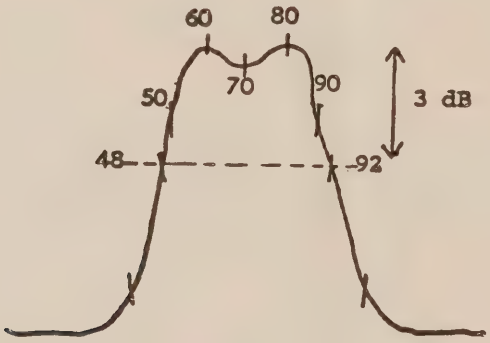
i. Connect the sweep generator to TP3 and E6 and adjust L14, L15, and L17 for the response as shown below. The 3 dB bandwidth is 60 MHz. L14 affects center frequency, L15 affects bandwidth, and L17 affects flat top response.



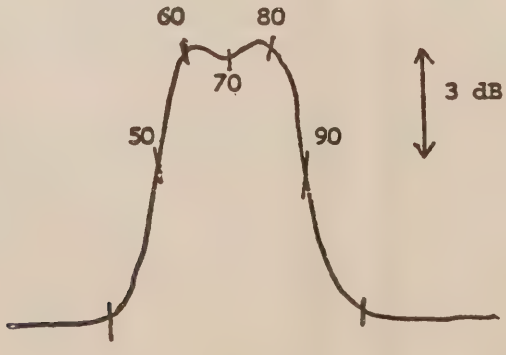
j. Connect the sweep generator to TP2 and E5. Note about a 6 dB increase in gain. Adjust L10, L11, and L13 for the response shown below. The 3 dB bandwidth is 48 MHz centered at 70 MHz. L10 affects center frequency, L11 affects bandwidth, and L13 affects flat top response.



k. Connect the sweep generator to TP1 and E4. Note about a 4 dB increase in gain. Adjust L6, L7, and L9 for a response as shown below. The 3 dB bandwidth is 43 MHz centered at 70 MHz, L6 affects center frequency, L7 affects bandwidth, and L9 affects flat top response.



l. Connect the sweep generator to the IF input E1. Note about 12 dB increase in gain. Adjust L2, L3, and L5 for a 40 MHz 3 bandwidth centered at 70 MHz as shown below.



m. Disconnect the sweep generator from the step attenuators (HP355D). Connect the signal generator, set to 70 MHz, to the step attenuators. Set the attenuators to 0 dB. Disconnect the 24-ohm adapter cable from E1 and connect it to the HP411 (terminated into 50 ohms). Adjust the output of the signal generator for -20 dBm indication on the HP411. Disconnect the HP411 and reconnect the adapter cable to E1 of the module.

n. Disconnect the D-10 detector from the adapter cable connected to E3 and connect the HP411 (with the 24 ohms in series) to the IF output, E3.

o. Set the step attenuators to 35 dB and adjust R54 until the HP411 indicates -20 dBm.

p. Set the AGC to -5.00V DC. Reset the attenuators to 0 dB and adjust R56 until the HP411 indicates -20 dBm.

q. Repeat steps o and p until the gain is 35 dB for 0.50V AGC, and 0 dB for -5.00V AGC.

This completes the alignment. Remove power from the receiver and disconnect the test equipment. Reinstall the module in the receiver.

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer, and manufacturer's part number for each electrical component used in the playback converter. Include all information when ordering spare or replaceable components.

Module Housing

Reference Designation	Description
A1	Printed Circuit Board Subassembly, Microdyne 103-002; see breakdown listing below
J1	Connector, p/o W1, Phelps-Dodge 700-171
J2	Connector, p/o W2, Phelps-Dodge 700-171
J3	Not Assigned
J4	Connector, 9 pin, AMP 205-204-1
W1	Cable Assembly, Microdyne 203-297-8
W2	Cable Assembly, Microdyne 203-297-8
Z1 thru Z3	Ferrite Bead, Fair Rite 2673000101

A1, Printed Circuit Board Subassembly

Reference Designation	Description
C1	Capacitor, ceramic, 330 pF ±20%, 100V, Erie 8111-100-X5R-331M
C2 thru C7	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C8	Capacitor, ceramic, 8.2 pF ±0.50 pF, 100V, Erie 8101-100-COG-829D
C9	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C10	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C11	Capacitor, ceramic, 9.1 pF ±0.5 pF, 100V, Erie 8101-100-COG-919D
C12	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C13 thru C18	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C19	Capacitor, ceramic, 13 pF ±5%, 100V, Erie 8111-100-COG-130J
C20	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C21	Capacitor, ceramic, 9.1 pF ±0.5 pF, 100V, Erie 8101-100-COG-919D

Replaceable Parts List - A1, Printed Circuit Board Subassembly, continued

Reference Designation	Description
C22	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C23 thru C27	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C28	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J
C29	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C30	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C31	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C32 thru C37	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C38	Capacitor, ceramic, 27 pF ±5%, 100V, Erie 8121-100-COG-270J
C39	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C40	Capacitor, ceramic, 9.1 pF ±0.50 pF, 100V, Erie 8101-100-COG-919D
C41	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C42	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C43 thru C46	Not Assigned
C47	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C48	Not Assigned
C49	Capacitor, ceramic, 100 pF ±5%, 100V, Erie 8131-100-COG-101J
C50 thru C61	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C62	Not Assigned
C63	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C64	Capacitor, ceramic, 27 pF ±5%, 100V, Erie 8121-100-COG-270J
C65	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8121-100-COG-910J
C66	Cqpacitor, ceramic, 91 pF ±5%, 100V, Erie 8121-100-COG-910J
C67	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J
C68	Capacitor, ceramic, 11 pF ±5%, 100V, Erie 8111-100-COG-110J
C69	Capacitor, ceramic, 36 pF ±5%, 100V, Erie 8121-100-COG-360J, nominal value
C70 thru C75	Not Assigned
C76	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C77	Not Assigned
C78 thru C81	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M

Replaceable Parts List - A1, Printed Circuit Board Subassembly, continued

Reference Designation	Description
C82	Not Assigned
C83	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C84	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
C85	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
CR1	Diode, 1N914
E1	Termination, integral part of Printed Circuit Board
E2	Not Assigned
E3	Termination, integral part of Printed Circuit Board
E4 thru E13	Termination, disc. pin, AMP 61067-1
E14	Terminal, USECO 2121-B
E15	Terminal, USECO 2121-B
L1	Inductor, fixed, 3.9 μH, Jeffers 4425-13K
L2	Inductor, variable, 1.0 μH, CTC 7107-13
L3	Inductor, variable, 0.33 μH, CTC 7107-07
L4	Not Assigned
L5	Inductor, variable, 0.33 μH, CTC 7107-07
L6	Inductor, variable, 1.0 μH, CTC 7107-13
L7	Inductor, variable, 0.33 μH, CTC 7107-07
L8	Not Assigned
L9	Inductor, variable, 0.33 μH, CTC 7107-07
L10	Inductor, variable, 1.0 μH, CTC 7107-13
L11	Inductor, variable, 0.33 μH, CTC 7107-07
L12	Not Assigned
L13	Inductor, variable, 0.33 μH, CTC 7107-07
L14	Inductor, variable, 1.0 μH, CTC 7107-13
L15	Inductor, variable, 0.33 μH, CTC 7107-07
L16	Inductor, fixed, 0.22 μH, Jeffers 4415-2M
L17	Inductor, variable, 0.33 μH, CTC 7107-07
L18 thru L21	Inductor, fixed, 3.9 μH, Jeffers 4425-13K
L22 thru L30	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L31	Not Assigned
L32	Inductor, variable, 0.15 μH, CTC 7107-03
L33	Inductor, variable, 0.10 μH, CTC 7107-01

Replaceable Parts List - A1, Printed Circuit Board Subassembly, continued

Reference Designation	Description
L34	Not Assigned
L35	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L36	Inductor, fixed, 0.47 μH, Jeffers 4425-2M
Q1	Transistor, fet, RCA 3N187
Q2	Transistor, fet, RCA 3N187
Q3	Transistor, RCA 2N3478
Q4	Transistor, fet, RCA 3N187
Q5	Transistor, RCA 2N3478
Q6	Transistor, fet, RCA 3N187
Q7	Transistor, RCA 2N3478
Q8	Transistor, fet, RCA 3N187
Q9	Transistor, Fairchild MT1061A
Q10	Not Assigned
Q11	Not Assigned
Q12	Transistor, Fairchild MT1061A
R1	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R2	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R3	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R4	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R5	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R6	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R7	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R8	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R9	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R10	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R11	Resistor, fixed composition, 110Ω ±5%, ¼w, Allen Bradley CB1115, nominal value
R12	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R13	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R14	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R15	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R16	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R17	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R18	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R19	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R20	Resistor, fixed composition, 110Ω ±5%, ¼w, Allen Bradley CB1115, nominal value
R21	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R22	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R23	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105

Replaceable Parts List - A1, Printed Circuit Board Subassembly, continued

Reference Designation	Description
R24	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R25	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R26	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R27	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R28	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R29	Resistor, fixed composition, 110Ω ±5%, ¼w, Allen Bradley CB1115, nominal value
R30	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R31	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R32	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R33	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5115
R34	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R35	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R36	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R37	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R38	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105, nominal value
R39	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R40	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R41	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R42	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R43	Resistor, fixed composition, 150Ω ±5%, ¼w, Allen Bradley CB1515
R44	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R45	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R46	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R47	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R48	Resistor, fixed composition, 330Ω ±5%, ¼w, Allen Bradley CB3315
R49 thru R52	Not Assigned
R53	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R54	Potentiometer, 5KΩ, Beckman 66WR-5K
R55	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R56	Potentiometer, 10KΩ, Beckman 66WR-10K
R57	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R58	Resistor, fixed composition, 180Ω ±5%, ¼w, Allen Bradley CB1815
R59	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R60	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R61	Resistor, fixed composition, 1.8KΩ ±5%, ¼w, Allen Bradley CB1825
R62	Resistor, fixed composition, 180Ω ±5%, ¼w, Allen Bradley CB1815, nominal value
R63	Not Assigned

Replaceable Parts List - A1, Printed Circuit Board Subassembly, continued

Reference Designation	Description
R64	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R65	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R66	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R67	Resistor, fixed composition, 62Ω ±5%, ¼w, Allen Bradley CB6205
R68	Resistor, fixed composition, 27Ω ±5%, ¼w, Allen Bradley CB2705
R69	Resistor, fixed composition, 24Ω ±5%, ¼w, Allen Bradley CB2405
R70	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215
R71 thru R73	Not Assigned
R74	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R75	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R76	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1005
R77	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R78	Not Assigned
R79	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R80	Not Assigned
R81	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
TP1 thru TP3	Test Point, disc. pin, AMP 61067-1
U1	Operational Amplifier, Fairchild μA741
Z1	Ferrite Bead, Fair Rite 2673000101
Z2	Ferrite Bead, Fair Rite 2673000101
Z3	Not Assigned
Z4 thru Z8	Ferrite Bead, Fair Rite 9820-1

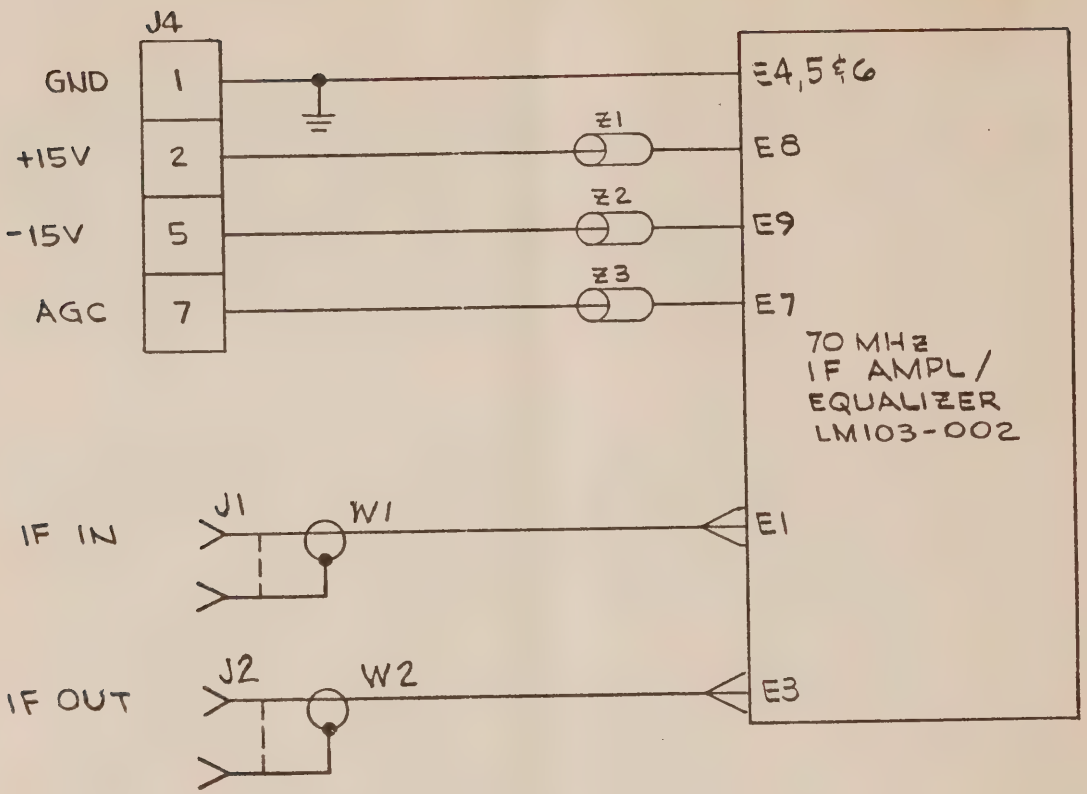


Figure 1. Module Wiring Diagram

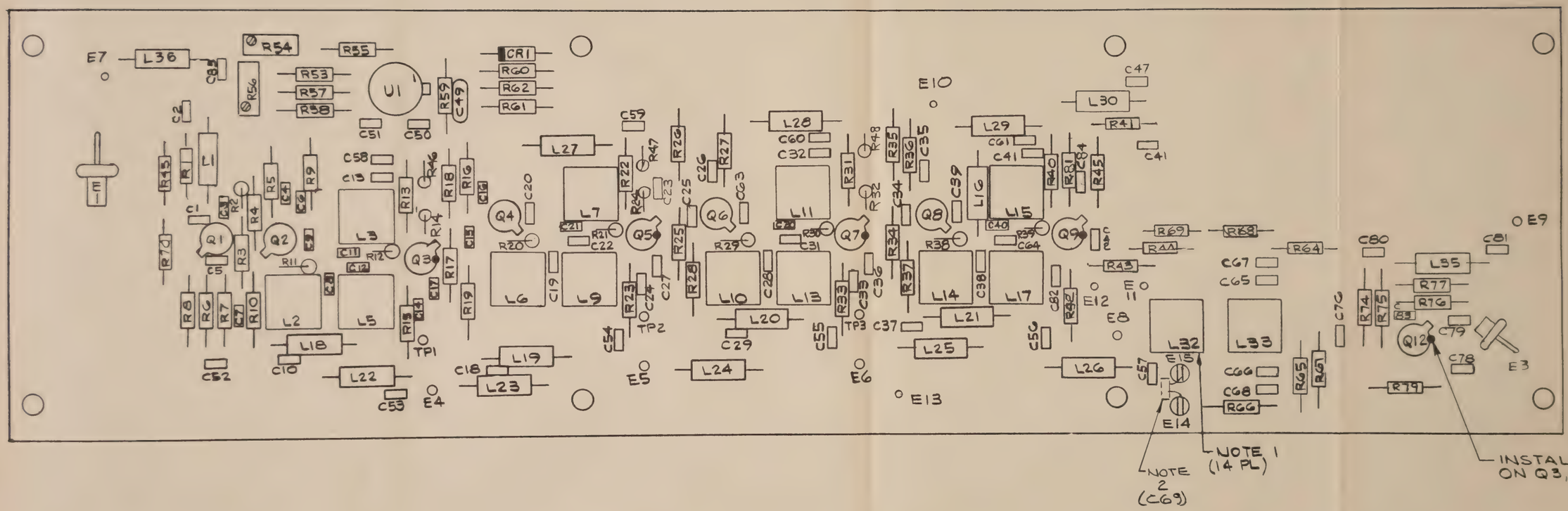


Figure 3. Printed Circuit Board, Component Location Drawing

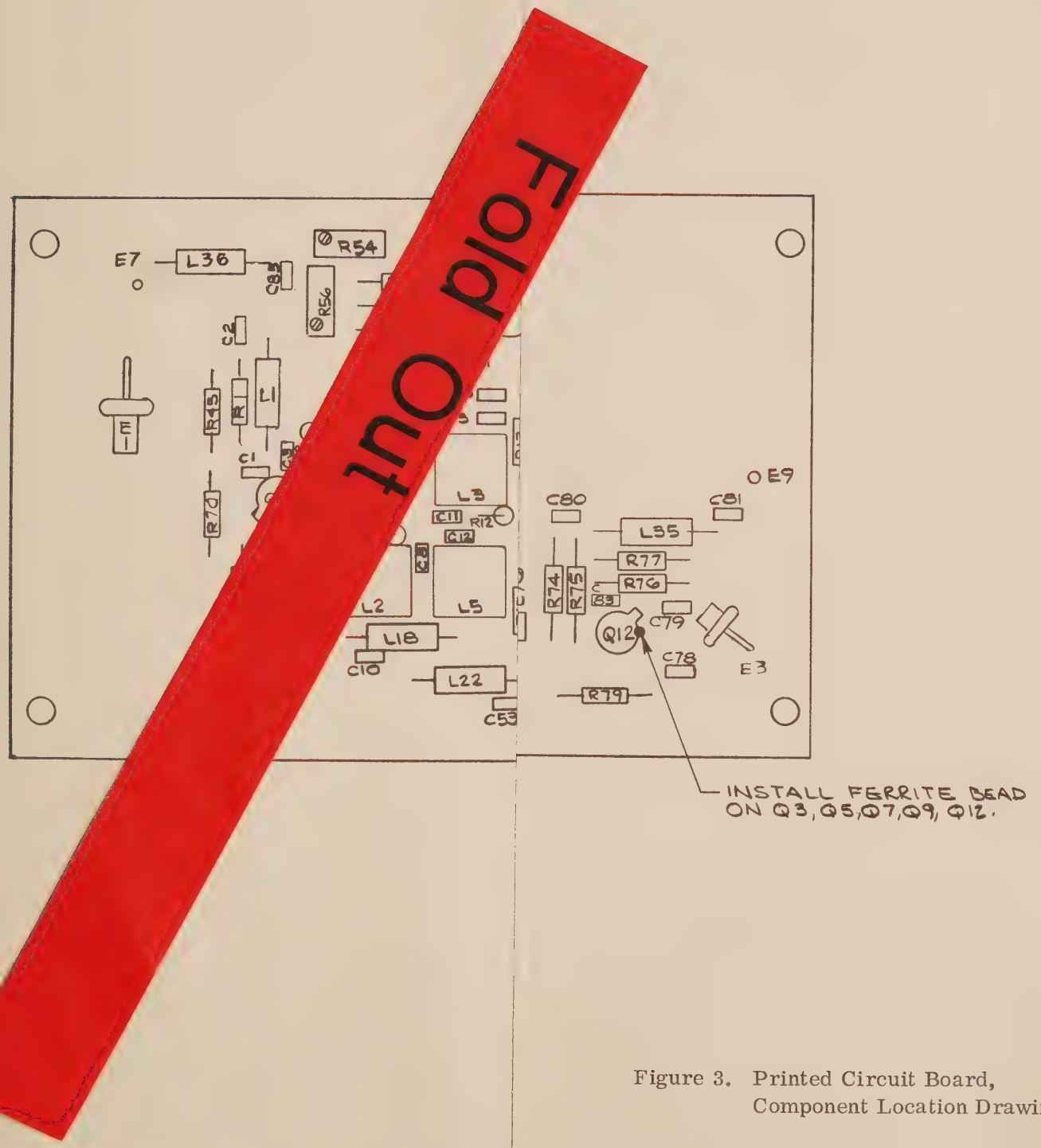


Figure 3. Printed Circuit Board, Component Location Drawing

Instruction Booklet

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101-996
AUDIO SUBCARRIER DISCRIMINATOR

March 1976

TRADE SECRETS

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ERRATA

The following changes should be inserted into the basic instruction booklet prior to its use in servicing and maintaing the subcarrier discriminator.

Replaceable Parts List/Schematic Diagram

C24 from 0.33 μF to 330 μF, Kemet T362D337M006AS
C25 from 43 pF to 10 pF, Erie 8101-100-COG-100J
R16 from 4.7K to 3.9K, CB 3925

Delete:
CR1, L1 (L6 is connected directly to +6V, E7).

Add:
R30, 56Ω $\pm$5%, $\frac{1}{4}$w, Allen Bradley CB5605 (between C23 and R6, in place of L7).

101-996 AUDIO SUBCARRIER DISCRIMINATOR

GENERAL

The 101-996 Audio Subcarrier Discriminator is used in the Microdyne series of wideband FM TV receivers to remove a 6.8 MHz FM subcarrier from a composite video signal, and extract the audio information from this subcarrier. The discriminator is designed to drive a 600 ohm balanced line.

INSTALLATION

No definite procedures are applicable to the module since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual under Repair and Replacement.

THEORY OF OPERATION

A schematic diagram of the audio subcarrier discriminator is shown in figure 3.

The input video signal is applied through E1 of the discriminator to a five pole filter that exhibits a 300 kHz bandwidth centered at 6.8 MHz. This filter functions to extract the 6.8 MHz FM subcarrier from the composite video signal.

The 6.8 MHz subcarrier is then applied to limiter U1. Here the signal is clipped and routed to discriminator U2 where the audio data is removed from the subcarrier. U2 is a double-end discriminator whose two outputs are combined in summing amplifier U3. The audio signal is routed across a 75 μsec de-emphasis network, R14-C29, which compensates for the pre-emphases network in the system's transponder.

This audio signal is then amplified by U3 and coupled to the front panel audio level control. From the level control, the signal is coupled to identical amplifiers which are configured to operate 180° out-of-phase with respect to each other. The result is two audio signals appearing at the two outputs, E2 and E3, of the module having identical levels but 180° out-of-phase. Each output is terminated into 300 ohms in the parent unit receiver, resulting in a 600 ohm balance line output.

MAINTENANCE

The following test equipment is recommended for servicing and maintaining the subcarrier discriminator.

Step Attenuator (1 dB)	HP355C	DC Voltmeter	HP412A
Sweep Generator	Wavetek 1050A	Test Oscillator	HP651A
Oscilloscope	Tektronix T932	FM Generator	Boonton Radio 202J
Frequency Counter	HP5381A	Univerter	Boonton Radio 207H

PREVENTIVE MAINTENANCE

The only preventive maintenance requirement for the discriminator is a semiannual inspection checking:

a. Resistors for discoloration or other evidence for overheating.

b. Connectors for corrosion and loose or damaged contacts.

c. Wiring for cut, cracked, or frayed insulation.

Any discrepancies noted during the inspection should be corrected immediately. Varify all connections against the schematic diagram before applying power.

TROUBLESHOOTING

In the event of a malfunction in the discriminator module, it is recommended that the signal tracing method of troubleshooting be employed. Also, the alignment procedures given herein may be attempted. In both cases, the procedures will isolate the area of signal loss or degradation.

ALIGNMENT

The following procedures are recommended for realigning the discriminator. These procedures should be conducted whenever a repair is made to the module.

a. Disconnect the cable connected to J1 of the module. Release the quarter-turn fasteners and lift out the module. The cabling to connector J2 is of sufficient length to allow the module to rest on the remaining modules; thus permitting servicing the discriminator in the receiver. Remove the cover from the module.

b. Apply power to the receiver.

c. Connect the SCOPE HORIZ output of the sweep generator to Horiz input on the oscilloscope.

d. Connect the SCOPE VERT output of the sweep generator to Vertical input on the oscilloscope.

e. Connect the RF OUT of the sweep generator to J1 on the module. Set the output of the sweep generator for a center frequency of 6.8 MHz.

f. Connect a high impedance detector to TP1 on the module.

g. Connect the output of the high impedance detector to DEMOD IN on the sweep generator.

h. Adjust L1 to L5 on the module for a flat response center at 6.8 MHz.

i. Disconnect the sweep generator. Connect the output of the HP651A signal generator to a 355C attenuator set to 6 dB. Connect the output of the 355C to J1 on the module. Set the output of the HP651A to +20 dBm at 6.8 MHz.

j. Connect a DC voltmeter to output of the high impedance detector and note the voltage as reference for use in the following steps.

k. Change the step attenuator from 6 dB to 3 dB. Vary the output frequency of generator above and below 6.8 MHz until the reference voltage (obtained in step j) is indicated.

Note the two frequencies. The difference of the two frequencies should be 300(±20) kHz.

l. Disconnect the DC voltmeter and high impedance detector from TP1 and the attenuator from J1.

m. Connect the RF output of an FM generator Boonton 202J to the univerter input (207H); set the output of the 202J to 200K microvolts.

n. Connect the frequency counter to the output of the univerter and adjust the FM generator for an output frequency of 6.8 MHz as noted on the counter.

o. Externally modulate the FM generator using 1 kHz from the test oscillator.

p. Set the deviation of the FM generator for 75 kHz at 1 kHz rate.

q. Connect the output of univerter (207H) to J1 of the module. Terminate the audio output terminals into the proper load, 300 ohms on TB1-1 and TB1-3.

r. Connect the DC voltmeter to TP4 and adjust R6 for 0 volts DC as indicated on the voltmeter.

s. Adjust front panel audio gain control for maximum output.

t. Connect the oscilloscope to TB1-3 (rear panel connector) and note the output level.

u. Connect oscilloscope to TB1-1 and adjust R21 for same level as indicated on TB2-3 in step t above.

v. Adjust R17 for 4V p-p as indicated on the oscilloscope as measured at TB1-1 and TB1-3.

This completes the alignment and test of the subcarrier discriminator. Remove power from the receiver, disconnect the test equipment and replace the module in the receiver.

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer, and manufacturer's part numbers for each electrical component used in the audio subcarrier discriminator. Include all information when ordering spare or replaceable components.

Module Housing

Reference Designation	Description
A1	Printed Circuit Board Assembly, 6.8 MHz, BW300 kHz, Microdyne 103-019; see breakdown listing below
C1	Capacitor, ceramic, 0.33 pF ±20%, 100V, Erie 8131-100-651-334M
C2	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
E1	Termination, standoff, Sealectro ST-SM-1
E2	Termination, standoff, Sealectro ST-SM-1
J1	Connector, p/o W1, Phelps Dodge 700171
P1	Connector, 9-pin, AMP 205-203-1
W1	Cable Assembly, Microdyne 203-297-8

Printed Circuit Board Assembly

Reference Designation	Description
C1	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C2	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J
C3	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J, nominal value
C4	Capacitor, ceramic, 18 pF ±5%, 100V, Erie 8111-100-COG-180J
C5	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J
C6	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J, nominal value
C7	Capacitor, ceramic, 9.1 pF ±0.5 pF, 100V, Erie 8101-100-COG-919D
C8	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J
C9	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J, nominal value

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
C10	Capacitor, ceramic, 6.8 pF ±0.25 pF, 100V, Erie 8101-100-COG-689C
C11	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J
C12	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J, nominal value
C13	Capacitor, ceramic, 9.1 pF ±0.5 pF, 100V, Erie 8101-100-COG-919D
C14	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J
C15	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J, nominal value
C16	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C17 thru C20	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C21	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
C22	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C23	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
C24	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C25	Capacitor, ceramic, 43 pF ±5%, 100V, Erie 8121-100-COG-430J
C26	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C27	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C28	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
C29	Capacitor, fixed, paper film, 0.01 μF ±10%, 80V, Sprague 192P1039R8
C30	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C31	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
CR1	Diode, 1N914
E1	Termination, cable, p/o W1, Microdyne
E2	Termination, cable, p/o W2, Microdyne
E3	Termination, cable, p/o W3, Microdyne
E4 thru E7	Termination, formed pin, AMP 61067-1
L1 thru L5	Inductor, Microdyne 203-264
L6	Inductor, 200 μH, Jeffers 1315-19J
L7	Inductor, 200 μH, Jeffers 1315-19J

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
R1	Resistor, fixed composition, 750Ω ±5%, ¼w, Allen Bradley CB7515
R2	Resistor, fixed composition, value selected during testing
R3	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R4	Resistor, fixed composition, 7.5KΩ ±5%, ¼w, Allen Bradley CB7525
R5	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R6	Potentiometer, 1KΩ, Beckman 66WR1K
R7	Resistor, fixed composition, 820Ω ±5%, ¼w, Allen Bradley CB8215
R8 thru R11	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R12	Resistor, fixed composition, 22KΩ ±5%, ¼w, Allen Bradley CB2235
R13	Resistor, fixed composition, 22KΩ ±5%, ¼w, Allen Bradley CB2235
R14	Resistor, fixed composition, 7.5KΩ ±5%, ¼w, Allen Bradley CB7525
R15	Resistor, fixed composition, 200KΩ ±5%, ¼w, Allen Bradley CB2045
R16	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R17	Potentiometer, 100K, Beckman 66WR100K
R18	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R19	Resistor, fixed composition, 15KΩ ±5%, ¼w, Allen Bradley CB1535
R20	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R21	Potentiometer, 5KΩ, Beckman 82PR5K
R22	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R23	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R24 thru R26	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R27	Resistor, fixed composition, 33KΩ ±5%, ¼w, Allen Bradley CB3335
R28	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R29	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
TP1 thru TP9	Test Point, formed pin, AMP 61067-1
U1	Integrated Circuit, RCA CA3012
U2	Integrated Circuit, Fairchild U6A960159X
U3	Integrated Circuit, Fairchild μ7A7747393
U4	Integrated Circuit, Fairchild μ7A7747393
XU1	Not Assigned
XU2 thru XU4	Socket, 14-pin, Augat 514-AG11D

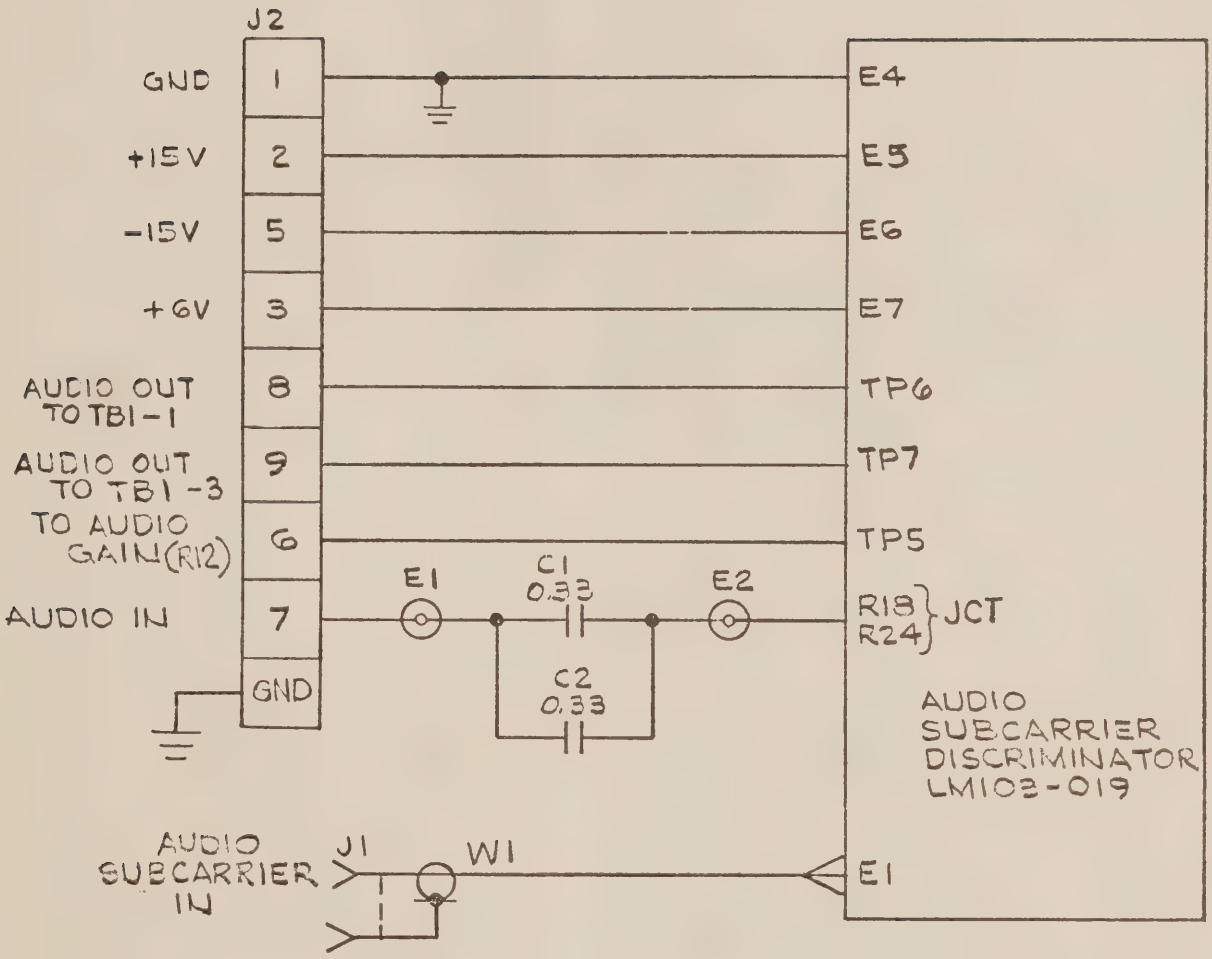


Figure 1. Module Wiring Diagram

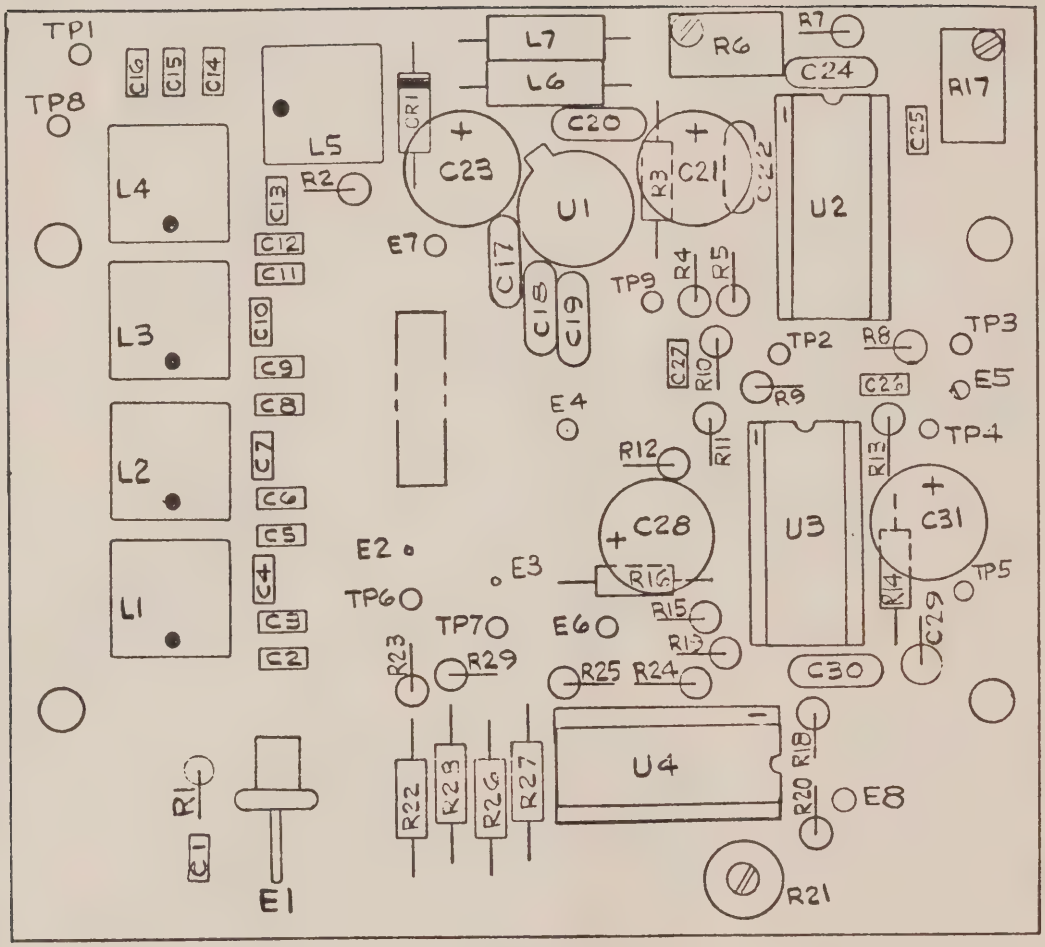
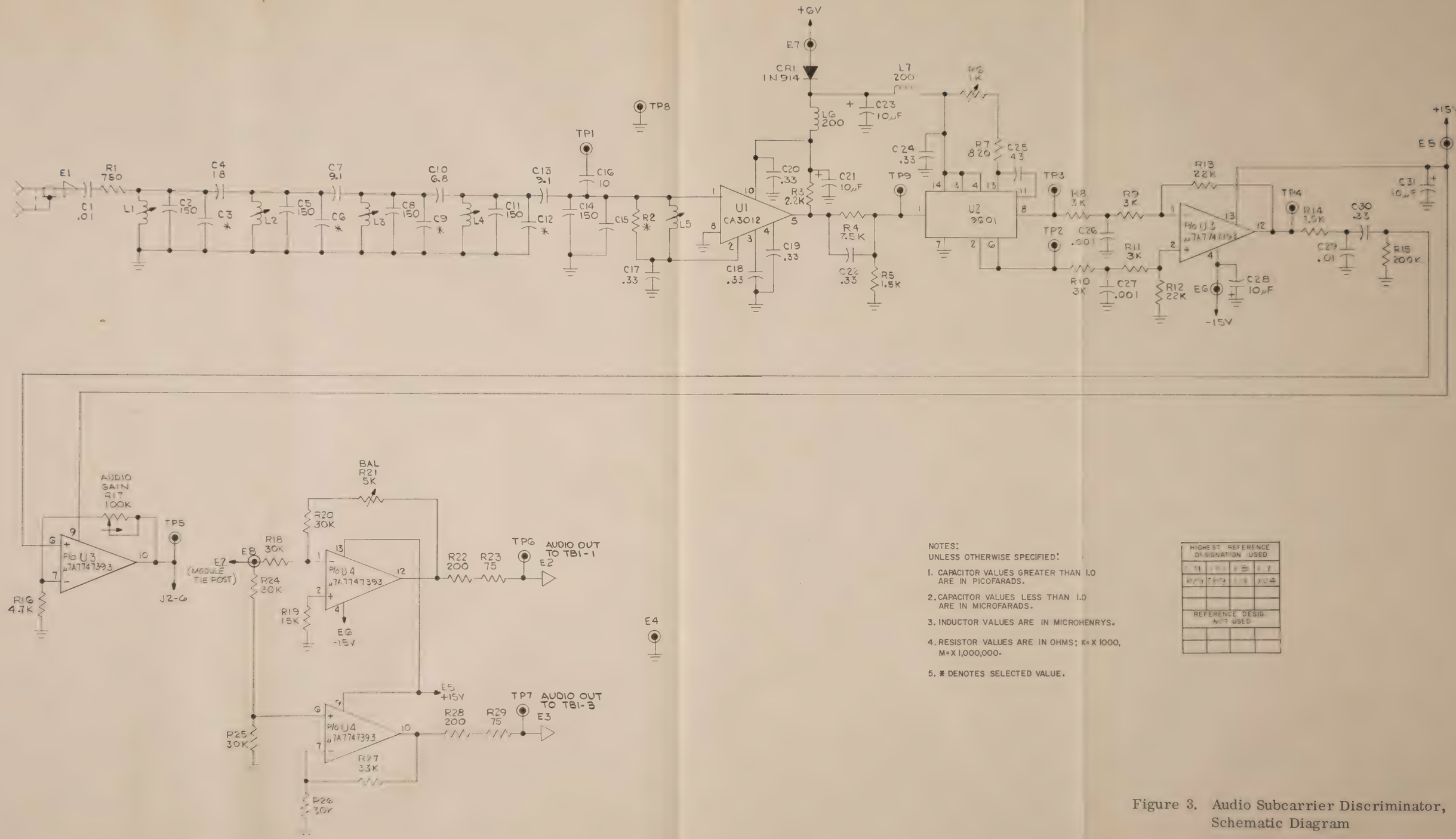


Figure 2. Printed Circuit Board,
Component Location Drawing



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. * DENOTES SELECTED VALUE.

HIGHEST REFERENCE DESIGNATION USED			
REFERENCE DESIG. NOT USED			

Figure 3. Audio Subcarrier Discriminator, Schematic Diagram

Instruction Booklet

101-997
70 MHz IF AMPLIFIER

April 1976

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ERRATA

The following change(s) should be inserted into the instruction booklet prior to its use in servicing and maintaining the IF Amplifier.

Replaceable Parts List

Change the value of L1 to read 3.9 μH, Jeffers 4425-13K.

Change the part number of R35 and R36 to 66WR10K.

101-997 IF AMPLIFIER

GENERAL

The 101-997 IF Amplifier is designed for use in the Microdyne 1100 Series of wideband FM receivers. The amplifier is used to establish a 70 MHz bandwidth of 48 MHz at the -3 dB points of the passband. A schematic diagram of the module is shown in figure 2.

INSTALLATION

No definite installation procedures are applicable to the amplifier module since it can be used in various receivers. Any special procedures required are specified in the parent unit instruction manual.

THEORY OF OPERATION

The 70 MHz IF signal is applied to J1 of the module and coupled to E1 of the amplifier board. From E1 the signal is coupled to a dual gate FET input amplifier. Output from this stage is applied to the first of two gain-controlled common source amplifiers, Q2 and Q4. The IF signal is applied to gate 1 and the AGC voltage is applied to gate 2 of the amplifier stages. Q3 functions as a buffer amplifier and is used to provide the proper input impedance for Q4.

A wideband double-tuned circuit is used between the amplifier stages. The purpose of the wideband stage is to ensure that the transfer response is flat as can be obtained.

U1 functions as the AGC buffer amplifier. R36 is the AGC slope control and R35 is the gain control. The amplifier exhibits an overall gain of 15 dB with -0.5V AGC, and unity gain with -5V AGC.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the amplifier module consists of a semiannual inspection checking for loose hardware, connectors, and components. Any discrepancies should be corrected immediately to ensure proper operation.

TROUBLESHOOTING

In the event that the module malfunctions, the problem can best be located by attempting an alignment. Once the defective component is located, it should be replaced with an identical component as referenced in the replaceable parts list. Procedures for replacing printed circuit board mounted components are given in the REPAIR section of the receiver manual.

ALIGNMENT

The following test equipment is required for aligning the amplifier module; equivalent equipment may be used:

Signal Generator	HP608
Sweep Generator	Wavetek 1050A
Switchable Attenuators	HP355D, HP355C
Oscilloscope	HP1200AR
RF Millivoltmeter	HP411
50-ohm Detector	Aertech D10
24-ohm Coaxial Adapter Cables (2)	Solder a 24-ohm, $\frac{1}{4}$w, (AB CB2405) resistor between two BNC connectors (1094) with ground lugs attached. Solder the ground lugs together.
Adapter Cable	BNC on one end and an SMB 700-233 right-angle connector on other, 12 inches long.

a. Release the quarter-turn fasteners that hold the module in place. Position the module so as to permit access to the internal circuitry. Remove the module cover.

b. Disconnect cabling to connectors J1, J2 and J4 of the module; do not disturb the power/agc cabling.

c. Apply power to the parent unit and place the agc in the Manual mode.

d. Adjust the manual agc control for -0.5V agc at E6 of the module. Adjust R35 (potentiometer closest to L3) for +3.5V at E8.

e. Connect the RF Out of the sweep generator to the input of HP355D attenuator, the output of the HP355D to the input of the HP355C attenuator, and the HP355C through a 24-ohm coax adapter cable to TP1 on the module.

f. Connect the SCOPE HORIZ and VERT outputs of the sweep generator to the corresponding inputs of the oscilloscope.

g. Connect the DEMOD output of the sweep generator through the Aertech D10 detector and a 24-ohm coax adapter cable to E2 of the module.

h. Set up the generator and the oscilloscope for a sweep response. Use maximum sweep from the generator.

i. Adjust L6 and L9 for a 60 MHz, 3 dB bandwidth centered at 70 MHz.

j. Connect the sweep generator to the IF input, E1. Note the gain increased approximately 10 dB. Adjust L2, L3, and L5 for a 48 MHz bandwidth response, centered at 70 MHz.

k. Disconnect the sweep generator from the step attenuators (HP355D, 355C). Connect the signal generator HP608 to the attenuators. Disconnect the 24-ohm adapter cable, attached to the attenuators, from E1 of the module. Connect the HP411 millivoltmeter to the free end of the adapter cable. Set the attenuators to 0 dB and adjust output of the signal generator to produce a -20 dBm indication on the HP411.

l. Disconnect the 50-ohm detector from the adapter cable connected to E2 of the module and connect the HP411 to this cable.

m. Using the Manual Gain Control in the parent unit, set the AGC to -0.5 volts. Set the attenuators for 15 dB and adjust R35 (closest to L3) until the HP411 indicates -20 dBm.

n. Set the AGC to -5.00 volts. Set the attenuator for 0 dB and adjust R36 (next to R35) until the HP411 indicates -20 dBm.

o. Repeat steps m and n until both readings are obtained.

This completes the alignment. Remove power from the receiver and disconnect the test equipment. Reinstall the IF Amplifier module in the receiver.

REPLACEABLE PARTS LIST

Module Housing

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 103-003; see breakdown listing below
J1	Connector, p/o W1
J2	Connector, p/o W2
J3	Connector (9 pin), AMP 205-204-1
J4	Connector, p/o W3
W1	Cable Assembly, Microdyne 203-297-4
W2	Cable Assembly, Microdyne 203-297-5
W3	Cable Assembly, Microdyne 203-297-5
Z1 thru Z3	Ferrite Bead, Fair Rite 267300101

Replaceable Parts List, continued

A1, Printed Circuit Board Assembly

Reference Designation	Description
C1	Capacitor, ceramic, 330 pF ±5%, 100V, Erie 8121-100-COG-331J
C2 thru C4	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C5	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C6 thru C8	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C9	Capacitor, ceramic, 12 pF ±5%, 100V, Erie 8111-100-COG-120J
C10	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C11	Capacitor, ceramic, 2.4 pF ±0.1 pF, 100V, Erie 8101-100-COG-249B
C12	Capacitor, ceramic, 13 pF ±5%, 100V, Erie 8111-100-COG-130J
C13	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C14	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C15	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C16	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C17	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C18	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8111-100-COG-150J
C19	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C20	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C21	Capacitor, ceramic, 3.3 μF ±0.1 pF, 100V, Erie 8101-100-COG-339B
C22	Capacitor, ceramic, 13 pF ±5%, 100V, Erie 8111-100-COG-130J
C23	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C24	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C25	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C26	Capacitor, ceramic, 82 pF ±5%, 100V, Erie 8121-100-COG-820J
C27	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C28 thru C37	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C38	Capacitor, ceramic, 100 pF ±5%, 100V, Erie 8131-100-COG-101J
C36	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8121-100-COG-181J
C37	Capacitor, ceramic, 100 pF ±5%, 100V, Erie 8131-100-COG-101J
E1 thru E3	Termination, part of PC Board
E4 thru E7	Termination, disc. pin, AMP 61067-1

Replaceable Parts List - A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
L1	Inductor, 39 μH, Jeffers 1315-2J
L2	Inductor, 0.68 μH, Cambion 7107-11
L3	Inductor, 1.0 μH, Cambion 7107-13
L4	Inductor, 0.33 μH, Jeffers 4425-1M
L5	Inductor, 0.56 μH, Jeffers 7107-10
L6	Inductor, 0.68 μH, Cambion 7107-11
L7	Inductor, 1.5 μH, Jeffers 4425-8K
L8	Inductor, 0.47 μH, Jeffers 4425-2M
L9	Inductor, 0.68 μH, Cambion 7107-11
L10	Inductor, 5.6 μH, Jeffers 4435-1K
L11	Inductor, 5.6 μH, Jeffers 4435-1K
L12	Inductor, 5.6 μH, Jeffers 4435-1K
L13	Inductor, 5.6 μH, Jeffers 4435-1K
L14	Inductor, 5.6 μH, Jeffers 4435-1K
L15	Inductor, 5.6 μH, Jeffers 4435-1K
Q1	Transistor, fet, RCA 3N187
Q2	Transistor, fet, RCA 3N187
Q3	Transistor, npn, Motorola 2N3478
Q4	Transistor, fet, RCA 3N187
Q5	Transistor, Fairchild MT1061A
Q6	Transistor, Fairchild MT1061A
R1	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R2	Resistor, fixed composition, 24KΩ ±5%, ¼w, Allen Bradley CB2345
R3	Resistor, fixed composition, 100KΩ ±5%, ¼w, Allen Bradley CB1045
R4	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R5	Resistor, fixed composition, 3.6KΩ ±5%, ¼w, Allen Bradley CB3625
R6	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R7	Resistor, fixed composition, 1.0KΩ ±5%, ¼w, Allen Bradley CB1025
R8	Resistor, fixed composition, 100KΩ ±5%, ¼w, Allen Bradley CB1045
R9	Resistor, fixed composition, 20KΩ ±5%, ¼w, Allen Bradley CB2035
R10	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R11	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R12	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R13	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215
R14	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R15	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R16	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R17	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R18	Resistor, fixed composition, 100KΩ ±5%, ¼w, Allen Bradley CB1045

Replaceable Parts List - A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
R19	Resistor, fixed composition, 20KΩ ±5%, ¼w, Allen Bradley CB2035
R20	Resistor, fixed composition 51Ω ±5%, ¼w, Allen Bradley CB5105
R21	Resistor, fixed composition, 1.0KΩ ±5%, ¼w, Allen Bradley CB1025
R22	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R23	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R24	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R25	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215
R26	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R27	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R28	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R29	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R30	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R31	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R32	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R33	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R34	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R35	Potentiometer, 10K, Beckman 66XR10K
R36	Potentiometer, 10K, Beckman 66XR10K
R37	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R38	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R39	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R40	Resistor, fixed composition, 180Ω ±5%, ¼w, Allen Bradley CB1815
R41	Resistor, fixed composition, 180Ω ±5%, ¼w, Allen Bradley CB1815
R42	Resistor, fixed composition, 150Ω ±5%, ¼w, Allen Bradley CB1545
R43	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
TP1	Test Terminal, Phelps Dodge 700-532
U1	Operational Amplifier, Fairchild μA741C
Z1 thru Z3	Ferrite Bead, Fair Rite 9820-1

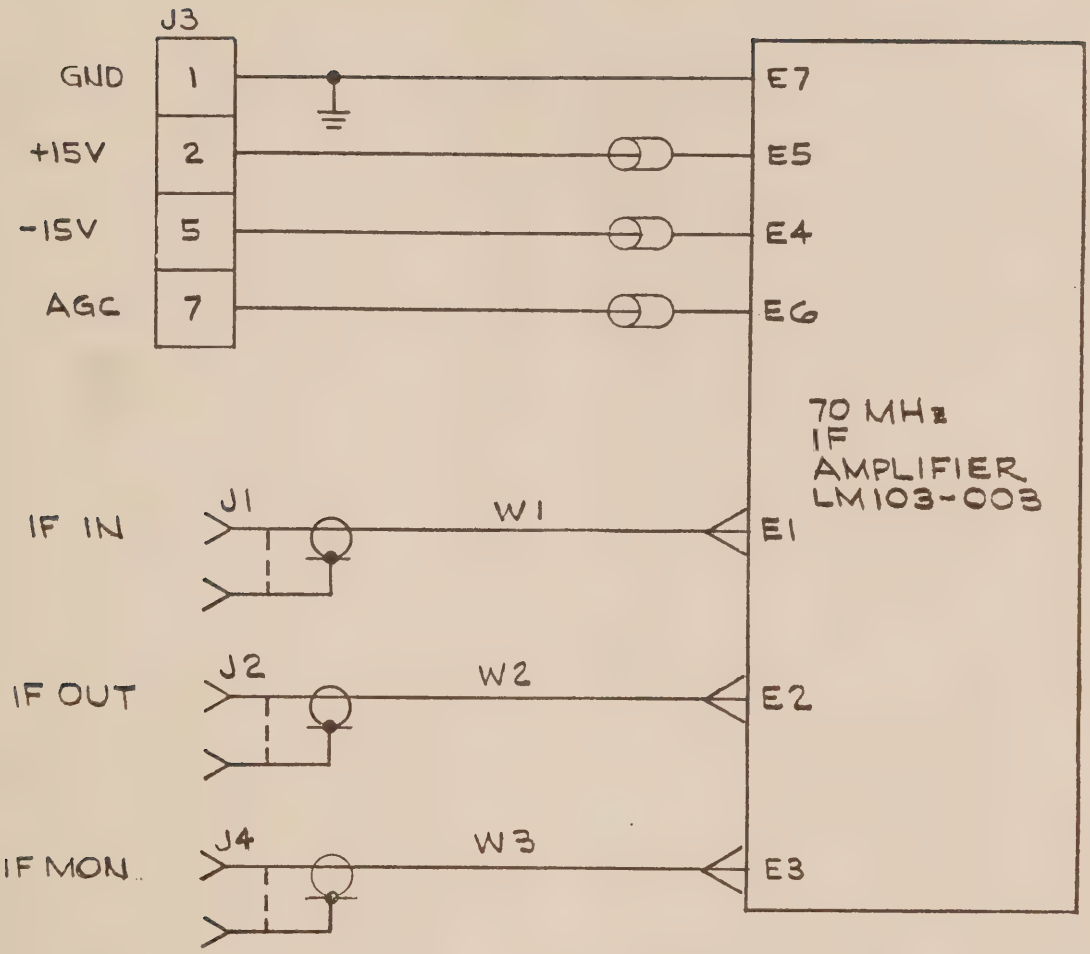
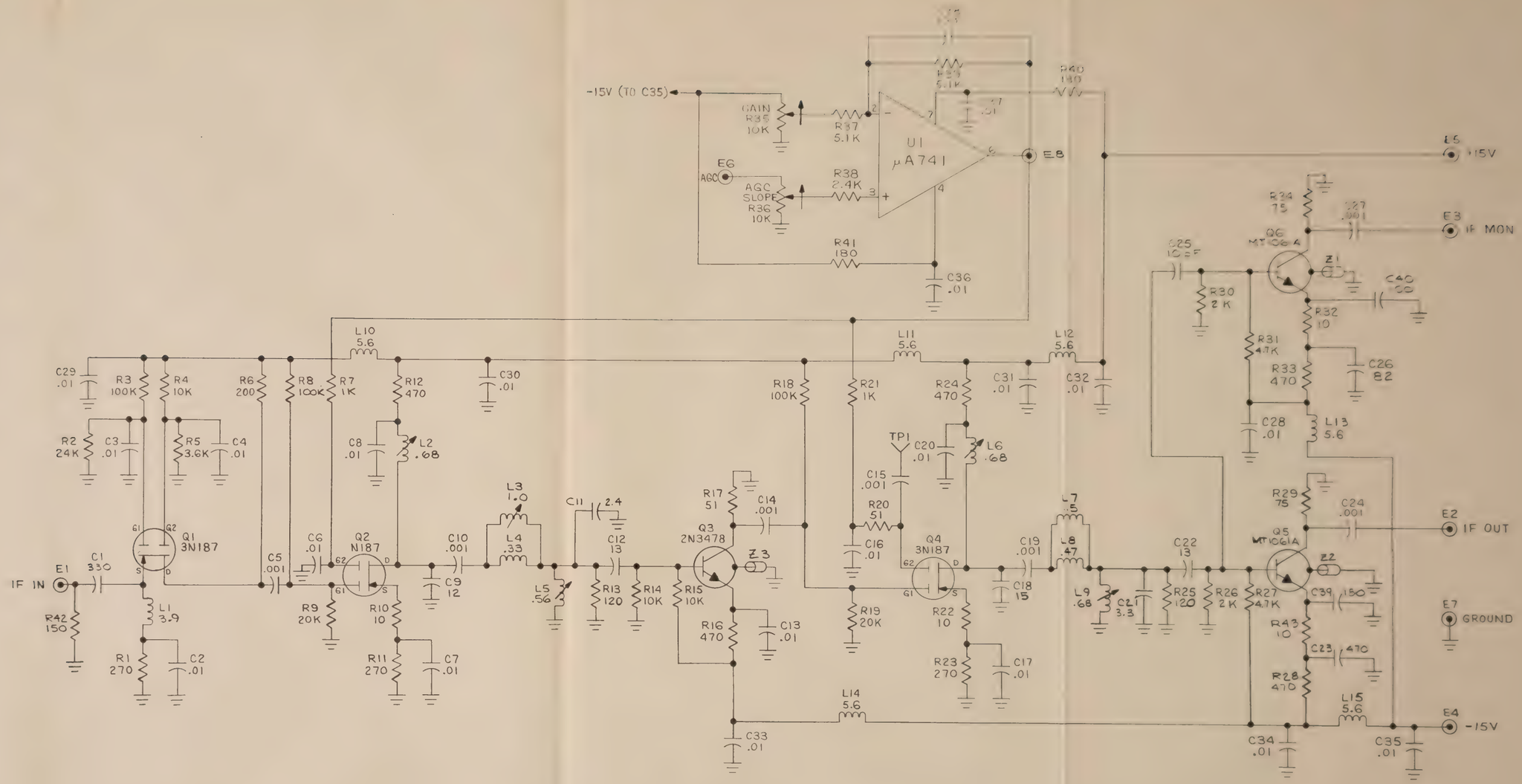


Figure 1. Module Wiring Diagram



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. ✱ DENOTES SELECTED VALUE.
6. —⊂⊃— FERRITE BEAD.

HIGHEST REFERENCE DESIGNATION USED			
C38	E7	L15	Q6
R41	U1		
REFERENCE DESIG. NOT USED			

Figure 2. 70 MHz IF Amplifier, Schematic Diagram

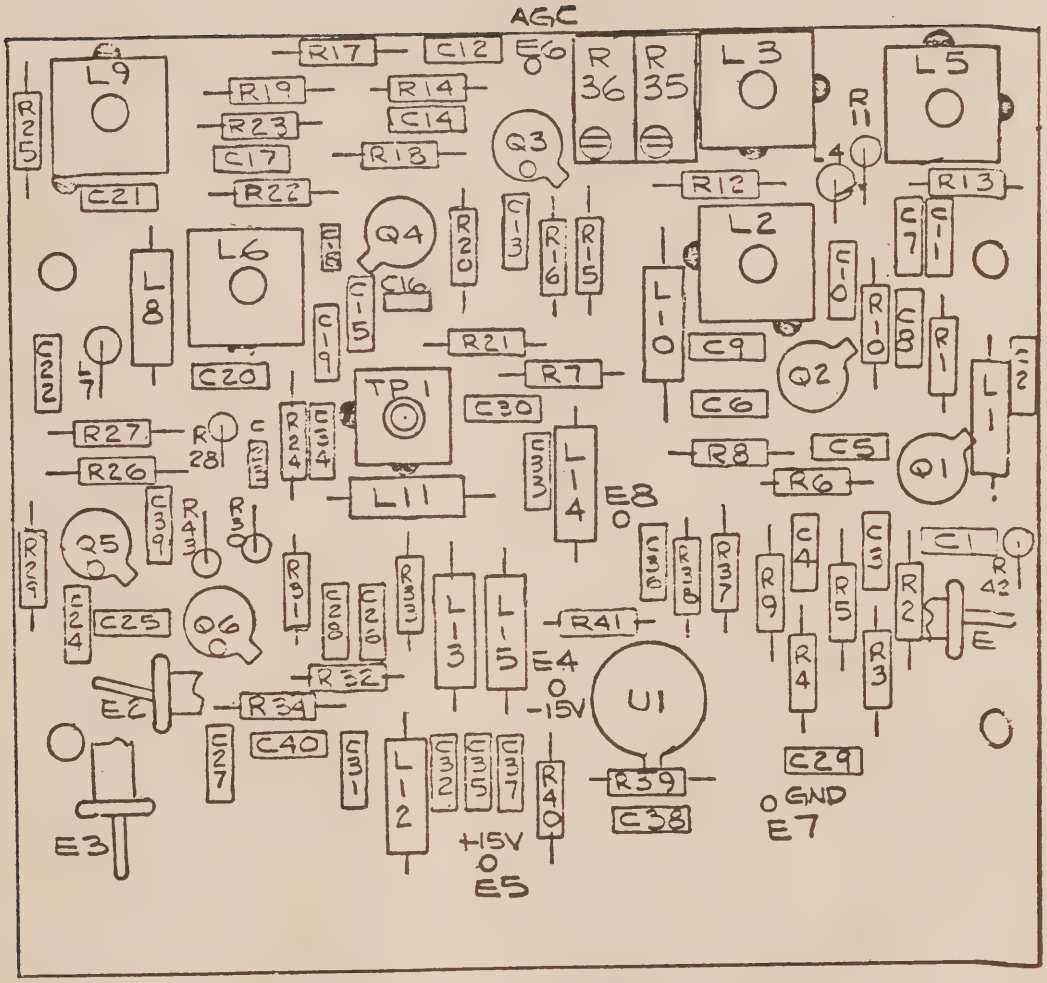


Figure 3. Printed Circuit Board,
Component Location Drawing

Instruction Booklet

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101-998
DE-EMPHASIS/VIDEO AMPLIFIER

March 1976

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101-998 DE-EMPHASIS/VIDEO AMPLIFIER

GENERAL

The 101-998 De-emphasis and Video Amplifier is employed in the Microdyne 1100 Series TV/Satellite Receivers. The 101-998 module comprises a de-emphasis network and a video amplifier.

INSTALLATION

No definite procedures are applicable to the module since it can be installed in various parent units. Any special procedure required to install the modules will be specified in the parent unit instruction manual under Repair and Replacement procedures.

THEORY OF OPERATION

A schematic diagram of the De-emphasis and Video Amplifier is shown in figure 3.

The module is designed to accept a composite video signal. This signal is applied to J1 of the module and routed to E1 of the printed circuit board assembly. The video signal is applied across a de-emphasis network which functions to compensate for the pre-emphasis network located in the transponder of the receiving system.

The video signal is then applied to video amplifier U1 which drives the de-emphasis video output at J2, and is the standard video output of the module. U1 also provides the drive for complimentary amplifier U3 which provides the audio subcarrier output at J3; this video output is designed for driving an audio subcarrier discriminator.

MAINTENANCE

The following equipment is recommended for servicing and maintaining the video amplifier.

NTSC Test Signal Generator	Tektronix 149A or 147A or equivalent
Pre-Emphasis Network	See Figure 1
Waveform Monitor	Tektronix 529 or equivalent
75 ohm Load	

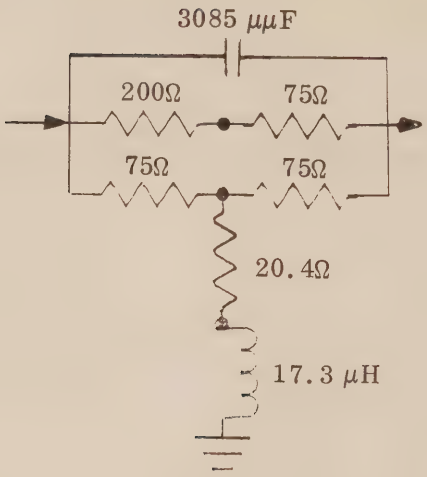

Figure 1. Pre-Emphasis Network

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the amplifier module consists of a semiannual inspection checking for loose hardware, connectors, and components. Any discrepancies should be corrected immediately to ensure proper operation.

TROUBLESHOOTING

It is recommended that the signal tracing method be used in troubleshooting the amplifier module. There are only two active stages employed in the module, U1 and U3. The video output at J2 can be used as a check of U1 and the video output at J3 can be used as a check of U3 (assuming the output at J2 is satisfactory). The alignment procedures provide a check of the de-emphasis network.

ALIGNMENT

The following procedures are those recommended for aligning the de-emphasis network. This adjustment should be attempted only after replacement of a component within the network.

a. Release the quarter-turn fasteners and lift out the module from the base chassis. Position the module so as to permit access to the module circuitry. Remove the cover from the module.

b. Disconnect the cabling to J1, J2 and J3 of the module. Do not disconnect the power input cables.

c. Construct the pre-emphasis network as shown in figure 1.

d. Connect the Tektronix NTSC Test Signal Generator to the de-emphasis/ video amplifier through the pre-emphasis network.

e. Connect J2 of the de-emphasis/video amplifier to the waveform monitor. Terminate the waveform monitor input with a 75 ohm load.

f. Set the test signal generator Full Field Signal Switch for a "Composite" signal. Set the Wave Monitor Display switch to 1 "Line" and the Volts Full Scale Switch to 1V or 0.5V, if necessary. Adjust the Volts Full Scale control for 140 IRE unit.

g. Adjust L1 for minimum distortion (tilt) on the leading and falling edges of the line bar test signal.

This completes the alignment, remove power and disconnect the test equipment. Replace the cover on the module and reinstall the module in the receiver.

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer, and manufacturer's part numbers for each electrical component used in the de-emphasis and video amplifier. Include all information when ordering spare or replaceable components.

Module Housing

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 103-004; see breakdown listing below
E1	Termination, p/o W1, Microdyne 200-150
E2	Not Assigned
E3	Termination, p/o W2, Microdyne 200-150
E4	Not Assigned
E5	Termination, p/o W3, Microdyne 200-150
J1	Connector, p/o W1, Phelps Dodge 700171
J2	Connector, p/o W3, Phelps Dodge 700171
J3	Connector, p/o W2, Phelps Dodge 700171
J4	Connector, 9-pin, AMP 205-204-1
W1	Cable Assembly, Microdyne 203-297-5
W2	Not Assigned
W3	Cable Assembly, Microdyne 203-297-5
W4	Not Assigned
W5	Cable Assembly, Microdyne 203-297-5

Printed Circuit Board Assembly

Reference Designation	Description
C1	Capacitor, 8200 pF, 100V, ±1%, Elmenco DM20-822F
C2	Capacitor, ceramic, 750 pF ±5%, 100V, Erie 8121-100-COG-751J
C3	Not Assigned
C4	Not Assigned
C5	Not Assigned
C6	Capacitor, ceramic, 1.0 pF ±5%, 100V, Erie 8101-100-COG-109B, factory selected, nominal value
C7	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C8	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M

Replaceable Parts List - Printed Circuit Board Assembly, continued

Reference Designation	Description
C9	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
C10	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
E1	Termination, integral part of PC Board
E2	Not Assigned
E3	Termination, integral part of PC Board
E4	Not Assigned
E5	Termination, integral part of PC Board
L1	Inductor, 42.7 - 51.7 μH, CTC 7107-33
R1	Resistor, 200Ω ±1%, ¼w, IRC RN55D2000F
R2	Resistor, 75Ω ±1%, ¼w, IRC RN55D75R0F
R3	Resistor, 75Ω ±1%, ¼w, IRC RN55D75R0F
R4	Resistor, 75Ω ±1%, ¼w, IRC RN55D75R0F
R5	Resistor, 20.5Ω ±1%, ¼w, IRC RN55D20R5F
R6	Resistor, fixed composition, 22Ω ±5%, ¼w, Allen Bradley CB2205
R7	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605
R8	Not Assigned
R9	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R10	Resistor, fixed composition, 2.0KΩ ±5%, ¼w, Allen Bradley CB2025
R11	Resistor, fixed composition, 390Ω ±5%, ¼w, Allen Bradley CB3915
R12	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R13	Resistor, fixed composition, 68Ω ±5%, ¼w, Allen Bradley CB6805
R14	Resistor, fixed composition, 68Ω ±5%, ¼w, Allen Bradley CB6805
R15	Resistor, fixed composition, 20KΩ ±5%, ¼w, Allen Bradley CB2035
R16	Resistor, fixed composition, 1.0KΩ ±5%, ¼w, Allen Bradley CB1025
R17	Resistor, fixed composition, 1.0KΩ ±5%, ¼w, Allen Bradley CB1025
R18	Resistor, fixed composition, 20KΩ ±5%, ¼w, Allen Bradley CB2035
R19	Resistor, fixed composition, 20Ω ±5%, ¼w, Allen Bradley CB2005
R20	Resistor, fixed composition, 20Ω ±5%, ¼w, Allen Bradley CB2005
R21	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605
U1	Operational amplifier, OEI 9804
U2	Not Assigned
U3	Integrated Circuit, Sprague TD602

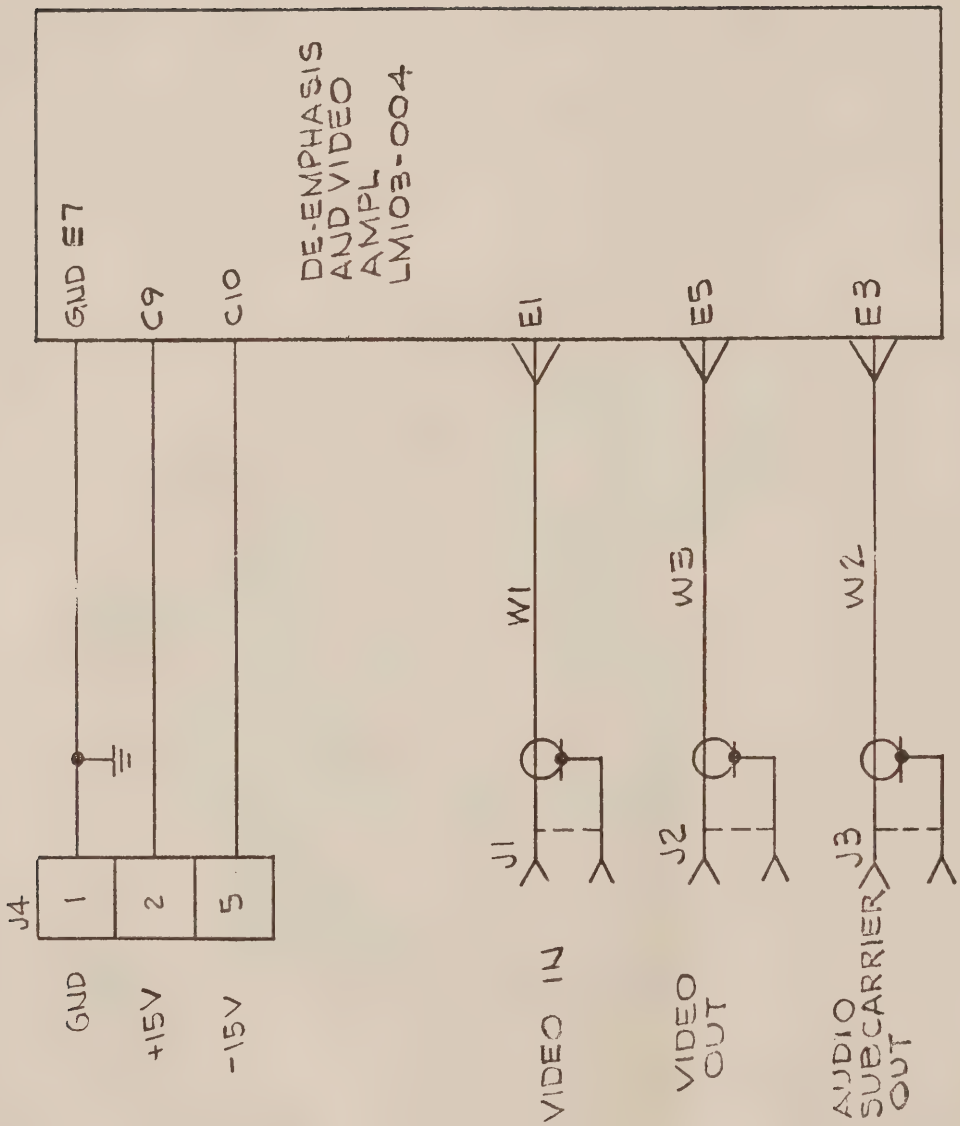

Figure 2. Module Wiring Diagram

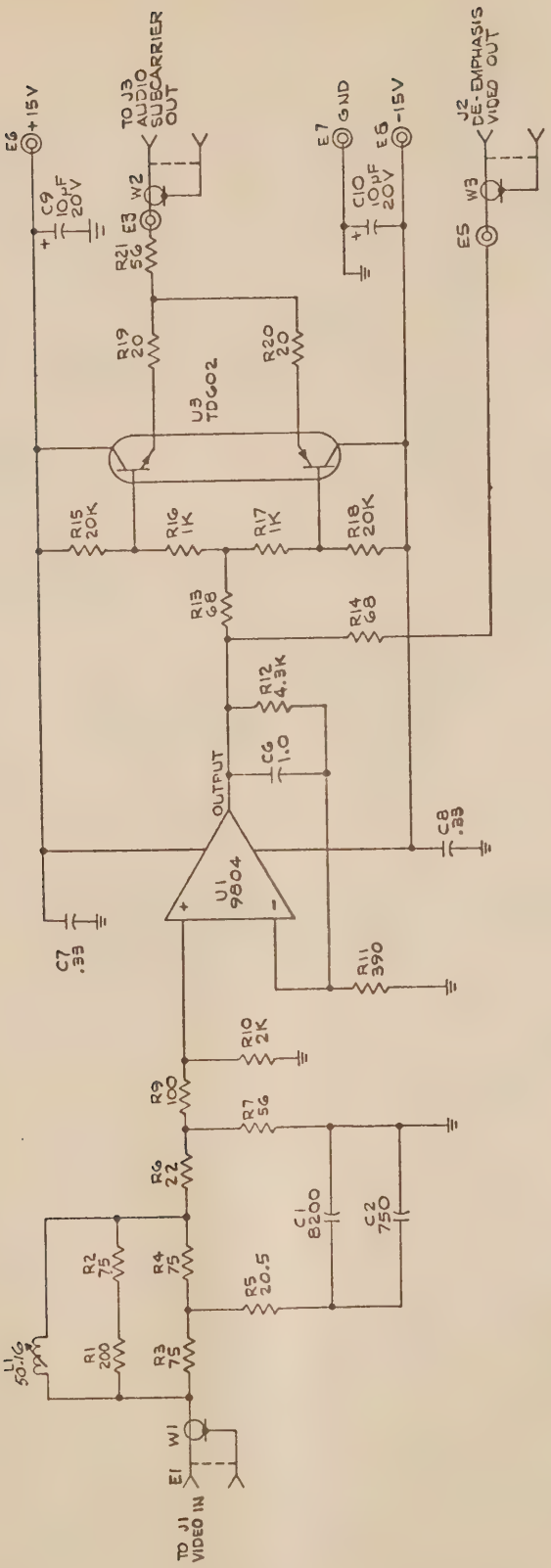

Figure 3. De-Emphasis/Video Amplifier, Schematic Diagram

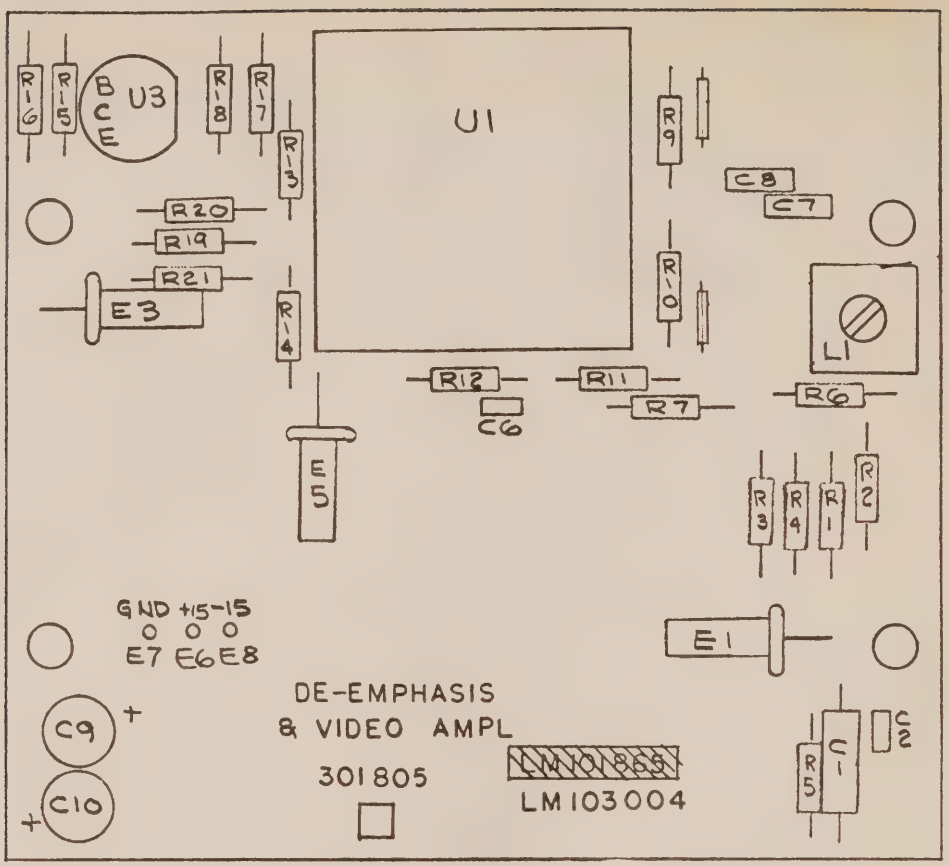

Figure 4. Printed Circuit Board, Component Location Drawing

Instruction Booklet

101-999 CLAMPER

March 1976

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101-999 CLAMPER

GENERAL

The 101-999 Clamper Module is employed in the Microdyne 1100 Series TV/Satellite Receiver and functions to remove or clamp the 30 Hz energy dispersing signal present on the video signal. This triangular signal is superimposed (FM) on the TV signal to disperse the transmitted CW signal so as to minimize interference with adjacent communications.

INSTALLATION

No definite installation procedure can be applied to the clamper as it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual under Repair and Replacement.

THEORY OF OPERATION

Reference figure 3, schematic diagram. The input to the clamper is the video signal from the receiver video amplifier. This composite video signal is simultaneously applied to the base of Q1 and Q6 of the clamper.

The circuitry comprising Q6 and Q11 generates the clamping signal. The 30 Hz dispersing signal is associated with the sync pulse and thus, the sync pulse is used as the reference in generating the clamping pulse.

The lowpass filter, R20 and C13, at the input of Q6 provides attenuation to the higher frequency signal and noise above 300 kHz. As a result, the video signal present at the collector of Q7 consists mainly of the sync pulse. This sync pulse is applied through Q8 to differentiator R27-C5 resulting in a negative pulse at the collector of Q11. This negative pulse is slightly delayed with respect to the trailing edge of the incoming sync pulse.

The composite video signal at the base of Q1 is coupled through emitter followers Q1 and Q2 across the back-porch clamper Q3 to the base of Q4. Upon the arrival of the sync pulse, Q3 is caused to go into saturation by the negative pulse from Q11. This results in the back-porch of the composite video signal to be clamped at ground potential, removing the 30 Hz dispersing signal. R6, C2, and L1 provide a high impedance to the color burst signal preventing it from being affected by the clamping action of Q3.

The clamped composite video signal is routed through complimentary amplifier U1 to the output of the module. R16, R17 and R18 provide an output impedance of 75 ohms.

MAINTENANCE

The following test equipment is recommended for use in servicing and maintaining the clamper module; equivalent equipment may be used.

Voltmeter Fluke 8000A

PREVENTIVE MAINTENANCE

The only preventive maintenance requirement for the clamper is a semiannual inspection checking:

a. Resistors for discoloration or other evidence for overheating.

b. Connectors for corrosion and loose or damaged contacts.

c. Wiring for cut, cracked, or frayed insulation.

Any discrepancies noted during the inspection should be corrected immediately. Varify all connections against the schematic diagram before applying power.

TROUBLESHOOTING

The recommended method for troubleshooting the clamper circuitry is to check the static dc voltages. Compare the voltages with those provided in table 1 below; the voltage may vary ±20%. There are no alignment or adjustment requirements for the clamper.

Table 1. Voltage Chart

	E	B	C
Q1	- .65	0	+15
Q2	- 1.32	- .65	+15
Q3	0	+ 8.79	- .79
Q4	- 1.44	- .79	+15
Q5	- .78	-14.4	+15
Q6	- .67	0	+15
Q7	0	- .67	- 8.30
Q8	- 8.96	- 8.3	0
Q9	-14.98	-14.28	-14.93
Q10	+ 2.59	+ 1.97	-14.98
Q11	+14.98	+14.22	+14.95
U5 (NPN Section)	- .78	- .18	+15
U5 (PNP Section)	- .81	- 1.3	+15

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer, and manufacturer's part numbers for each electrical component used in the clamper. Include all information when ordering spare or replaceable components.

Module Assembly

Reference Designation	Description
A1	Printed Circuit Board Subassembly, Microdyne 101-863; see breakdown listing below.
E1	Termination, p/o W1, Microdyne 200-150
E2	Termination, p/o W2, Microdyne 200-150
J1	Connector, p/o W1, Phelps Dodge 700171
J2	Connector, p/o W2, Phelps Dodge 700171
J3	Connector, 9-pin, AMP 205-204-1
J4	Connector, AMP 700171
TP1	Test Point, feed-thru, Sealectro FT-SM-1
W1	Cable Assembly, Microdyne 203-297-7
W2	Cable Assembly, Microdyne 203-297-6
Z1	Ferrite Bead, Fair Rite 2673000101
Z2	Ferrite Bead, Fair Rite 2673000101

Printed Circuit Board Subassembly

Reference Designation	Description
C1	Capacitor, ceramic, 0.1 μF ±10%, 100V, Erie 8133-000-W5R0-104K
C2	Capacitor, ceramic, 51 pF ±5%, 100V, Erie 8131-100-COG-510J
C3	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8111-100-COG-100J
C4	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C5	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C6	Capacitor, ceramic, 22 pF ±5%, 100V, Erie 8111-100-COG-220J
C7	Capacitor, ceramic, 750 pF ±5%, 100V, Erie 8121-100-COG-751J
C8	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C9	Capacitor, tantalum, 47 μF, 35V, Kemet T362D476M035AS
C10	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C11	Capacitor, tantalum, 47 μF, 35V, Kemet T362D476M035AS
C12	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C13	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J

Replaceable Parts List - Printed Circuit Board Subassembly, continued

Reference Designation	Description
CR1	Diode, JEDEC 1N914
CR2	Diode, JEDEC 1N914
E1	Cable Termination, integral part of PC Board
E2	Cable Termination, integral part of PC Board
E3 thru E7	Termination, AMP 61067-1
L1	Inductor, 33 μH, Jeffers 4465-2J
Q1	Transistor, npn, Motorola 2N3904
Q2	Transistor, npn, Motorola 2N3904
Q3	Transistor, pnp, Motorola 2N3906
Q4	Transistor, npn, Motorola 2N3904
Q5	Transistor, pnp, Motorola 2N3906
Q6	Transistor, npn, Motorola 2N3904
Q7	Transistor, pnp, Motorola 2N3906
Q8	Transistor, npn, Motorola 2N3904
Q9	Transistor, npn, Motorola 2N3904
Q10	Transistor, pnp, Motorola 2N3906
Q11	Transistor, pnp, Motorola 2N3906
R1	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R2	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
R3	Resistor, fixed composition, 300Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3015
R4	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R5	Resistor, fixed composition, 2.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2725
R6	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R7	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R8	Resistor, fixed composition, 510KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R9	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R10	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R11	Resistor, fixed composition, 2.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2725
R12	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R13	Not Assigned
R14	Not Assigned
R15	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R16	Resistor, fixed composition, 11Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1105
R17	Resistor, fixed composition, 11Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1105

Replaceable Parts List - Printed Circuit Board Subassembly, continued

Reference Designation	Description
R18	Resistor, fixed composition, 62Ω ±5%, ¼w, Allen Bradley CB6205
R19	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R20	Resistor, fixed composition, 3.3KΩ ±5%, ¼w, Allen Bradley CB3325
R21	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R22	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R23	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R24	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R25	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R26	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R27	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R28	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R29	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R30	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R31	Resistor, fixed composition, 22KΩ ±5%, ¼w, Allen Bradley CB2235
R32	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R33	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
U1	Integrated Circuit, Sprague TD602

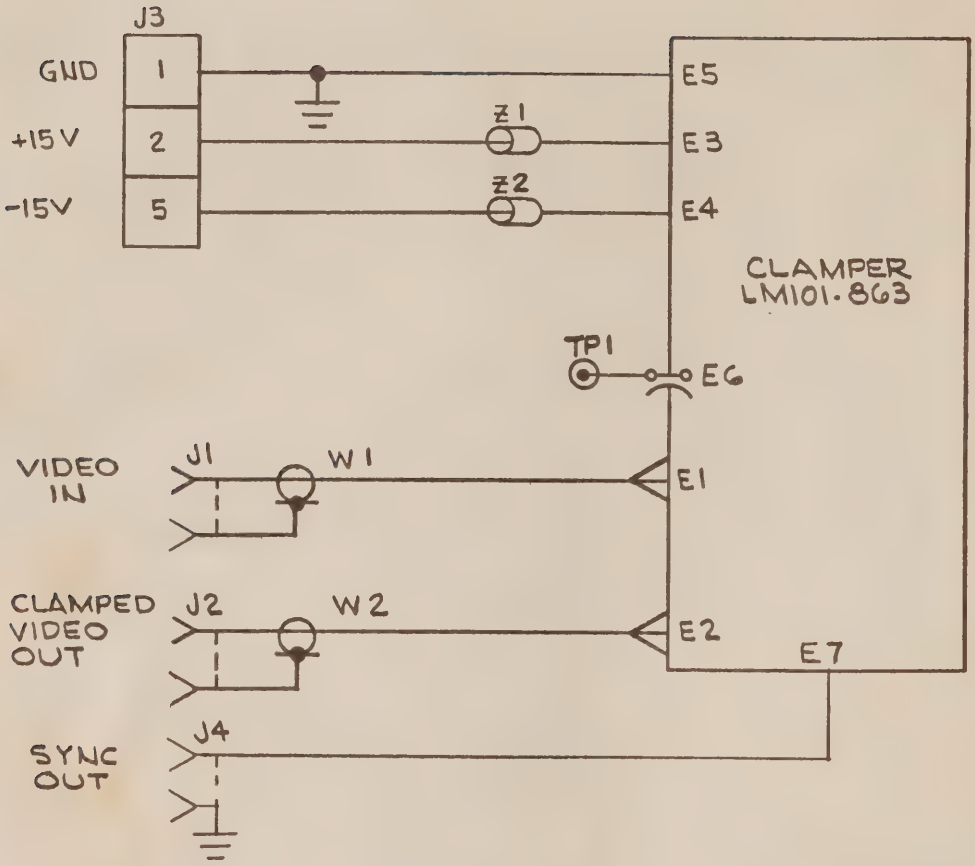

Figure 1. Module Wiring Diagram

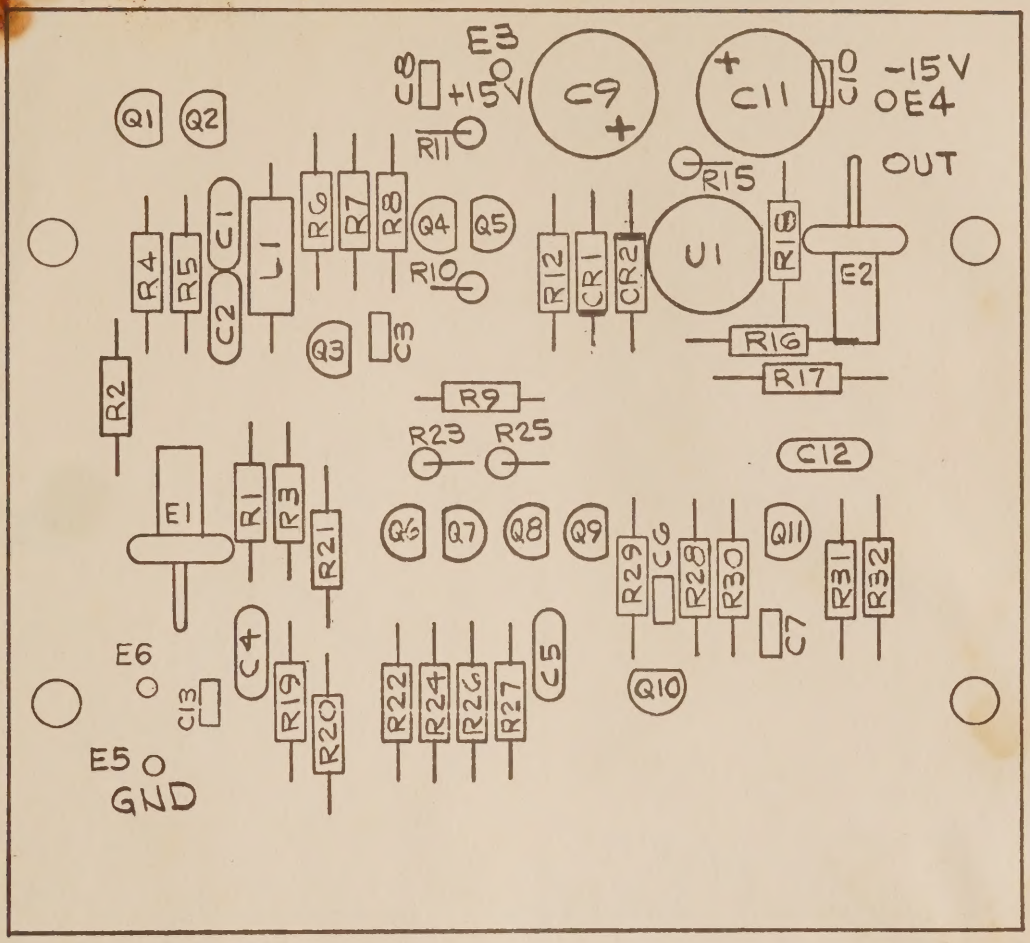

Figure 2, Printed Circuit Board,
Component Location Drawing

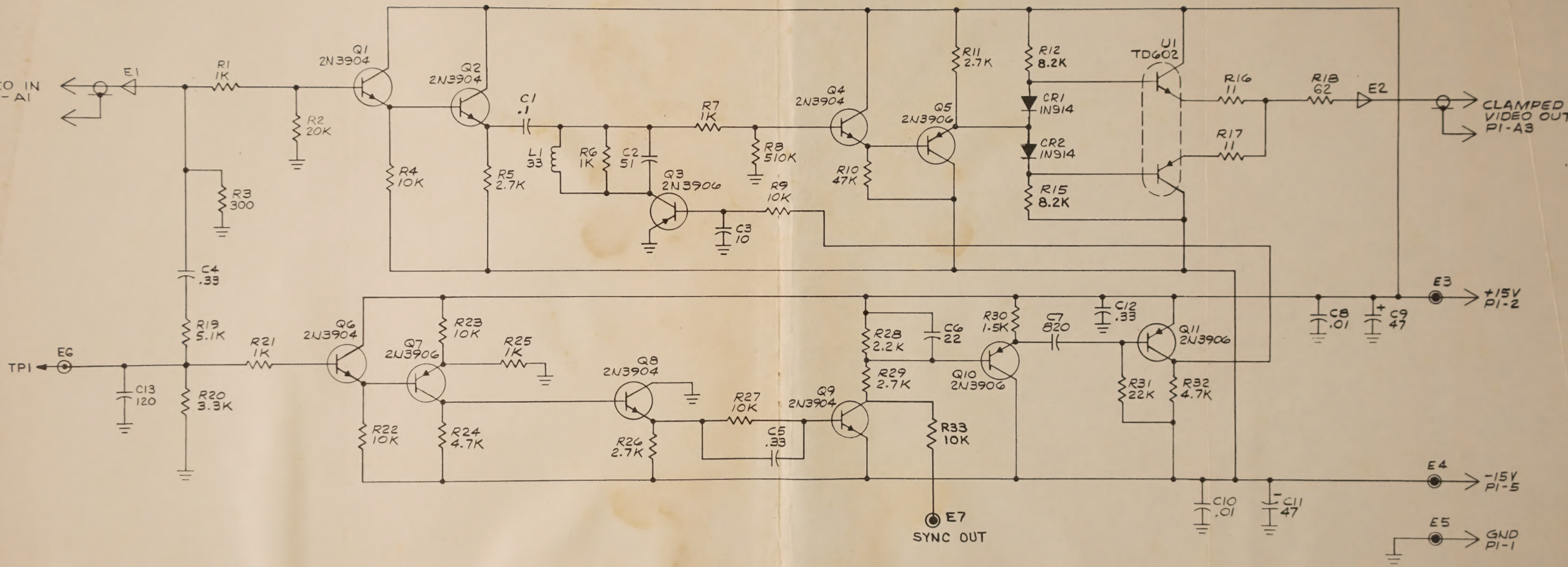

Figure 3. Clamper Assembly, Schematic Diagram